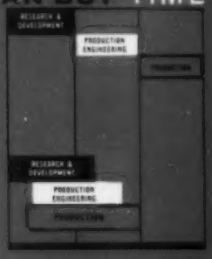
APRIL 7, 1958 PRICE 50 CENTS

R&D Research and Development news edition

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN RESEARCH AND DEVELOPMENT

HOW YOU CAN BUY TIME



see page 32

MONORAIL:

safety...speed...and silence...

see page 19

E & POWER GS
UNIVERSITY MICROFILMS
313 N 1 ST
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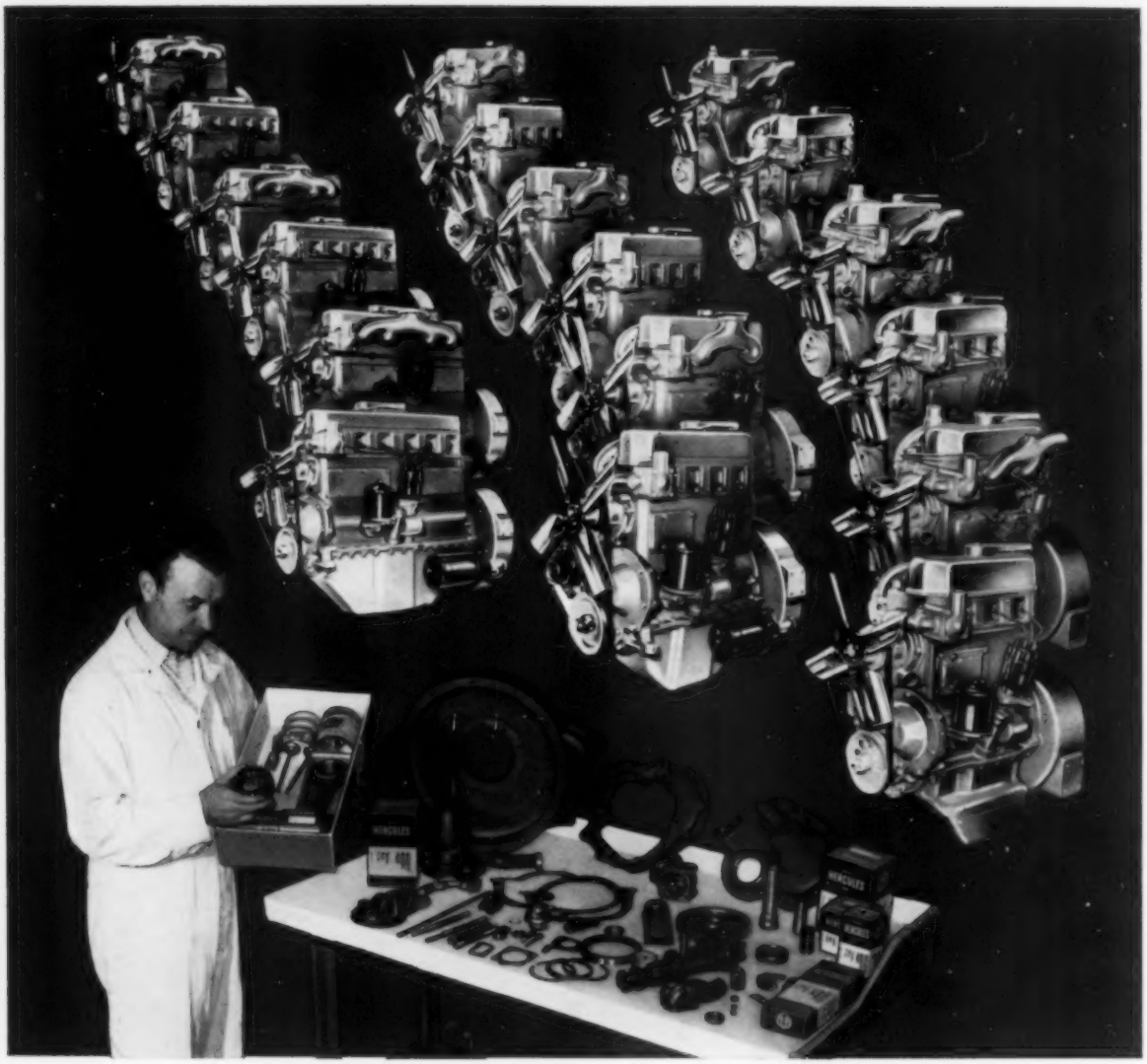

One set of spare parts serves all these 18 HERCULES engines

Here's parts interchangeability to warm a maintenance man's heart! Hercules designed the new DD diesel and GO gasoline engines with the user in mind: succeeded in achieving a unique degree of interchangeability that reduces spare parts requirements for Hercules-powered equipment to a minimum.

Actually, the illustration above doesn't tell the whole story. To do that, we'd have to show 6 power units as well as all 18 models of 3, 4, and 6-cylinder engines available in the DD and GO series—a total of 24 power plants using many of the same wearing parts!

This maintenance economy is another reason you should specify dependable Hercules gasoline, diesel, or LP-gas engines for the equipment you build. For the full story on these engines, write Hercules Motors Corp., Canton 2, Ohio—or call your Hercules distributor: there's one in the Hercules worldwide network near you.

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The following articles will be available next week. Single copies are free, while the supply lasts.

Pressure Drops in Air Valves

Molded Silicon Rubber Parts

12 Ways to Load Test Gears

Multirate Helical Springs

Which Cantilever Beam is Best

Which Way to Make a Cam

7 Ways to Start High-inertia Loads

Exotic Metals Seek Employment

Which Adhesive for What

Textured Steel

Bearings for 300 F and Up

Plastics for Abrasion Resistance

coming next week . . .

the DESIGN edition

for April 14

FEATURING:

- **Atomic energy: the facts.**
  Here's where we stand, and how we can step up future progress.

- **Semiconductors—revolution at your elbow.**
  Solid-state physicists see a growing number of fascinating, and important, applications ahead.

- **A fresh look at leaded steel.**
  The addition of lead gives good machinability and less worry about loss of tensile, impact and fatigue strengths.

- **Molded silicone rubber parts.**
  Tips on curing methods, shape of part and other variables.

- **Pressure drops in air valves.**
  A technique for estimating pressure losses in a pneumatic system, component by component.

- **12 Ways to retain electron tubes.**
  A mechanical problem—here's what's available, their advantages and disadvantages.

- **Spring clutches for faster response.**
  A helical spring bridging input and output shafts is ideal for high-speed indexing.

- **Shrink-fit nomograph.**
  For steel and cast-iron rings of equal length.

Product Engineering

McGRAW-HILL MAGAZINE OF DESIGN, RESEARCH AND DEVELOPMENT

R and D Research and Development news edition

April 7, 1958 Vol. 29, No. 14

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Product Engineering ..... SIDELIGHTS

R and D RESEARCH and DEVELOPMENT news edition

HOW YOU CAN BUY TIME

● **Long lead times** for R & D work may be shortened by overlapping schedules (p. 22) but certain practices defy the scheduler's bravest efforts. From the West Coast we hear of an engineer who did a double-take when he passed an inspection bench and saw the inspector with a book of Army-Navy standards propped open in front of him. He was busy with micrometer and thread gage, checking woodscrews used to assemble boxes in which the company's product is shipped.

● **Top executives** just don't like the reports they receive from R & D departments. In a survey by Scientific Apparatus Makers Assoc. of 500 presidents and executive vice-presidents, only one in seven found their R & D reports even satisfactory. They wanted more significant conclusions, more stress on implications of results, more attention to the potential market value of research work. Researchers are therefore expected to be not only brilliant and inventive. They must also be expert market analysts, economists and applications engineers.

This is where we get off the bandwagon. Engineers have gone much more than halfway toward meeting the lay public on its own terms. We can't all be da Vincis. Let the presidents, for a change, put a little more effort into understanding and interpreting the findings of their own R & D departments. If that's not their job, what is?

● **When inquiring about conferences** (p. 36) we found one cynical definition that may have more than a grain of truth. A conference, says this lexicographer, is a place where conversation is substituted for the dreariness of labor and the loneliness of thought.

● **Speaking of definitions,** and remembering some of the recently quoted testimony and newspaper interviews of engineering, rocket and space age specialists, we are moved to reprint the definition of an expert. X, we all studied, symbolizes an unknown quantity. A spurt (spert?), for all practical purposes, is a drip under pressure.

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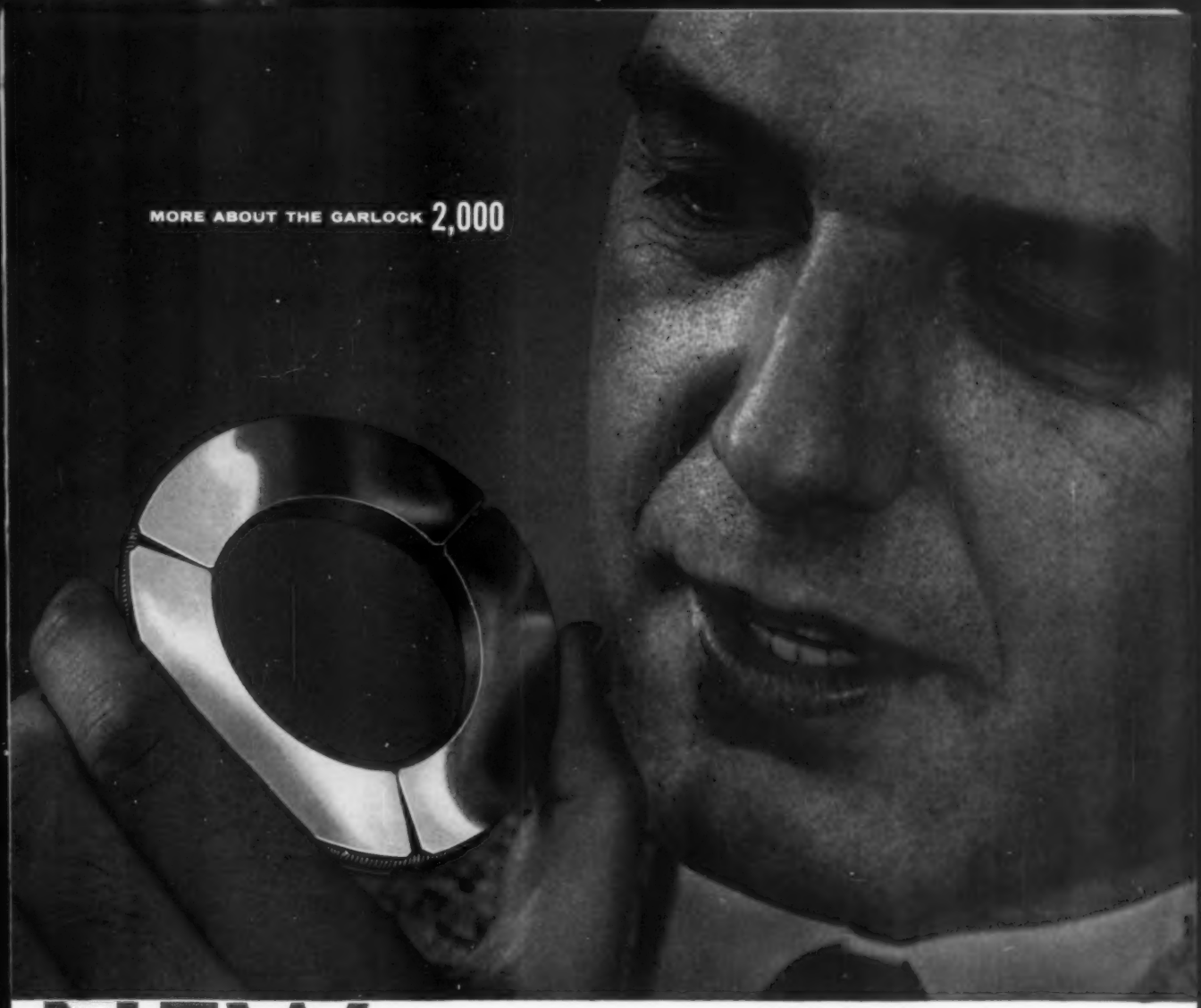

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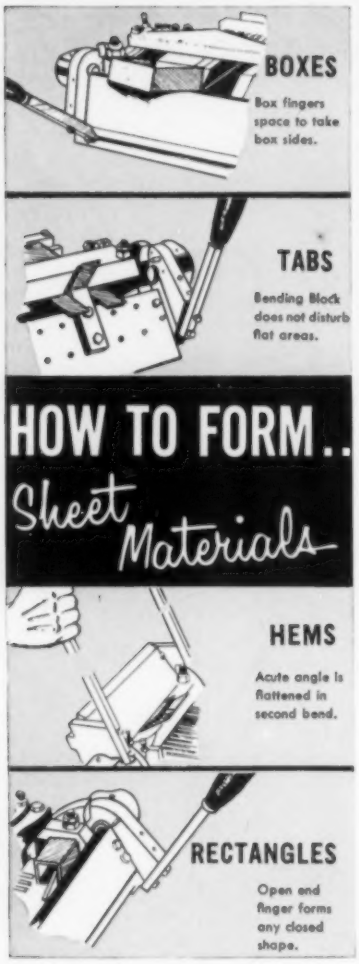

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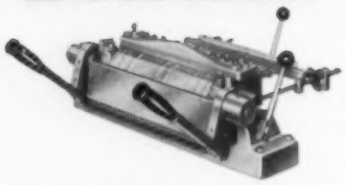
DI-ACRO BRAKE



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READER TO EDITOR

Liberty, Equality—and 65

To the Editor:

Sometimes, things puzzle me. When I came to this country at the age of 38, I was warned that I had better find a good connection before I was 40. I never could figure out what the magic of the figure 40 was. Neither can I now, looking at page 40 of PRODUCT ENGINEERING, Feb. 10, determine just what the magic of the figure 65 might be.

Possibly, some lawmaker has established 65 as an age at which, he felt, he was getting tired of law. Actually quite a few men in his occupation, and others, are remarkably active at a much more advanced age. In any event, universal application of such an arbitrary figure would appear silly, to say the least. The concept of age limits seems an outcrop of the materialist philosophy of Marx and his group, since it ultimately rests on egalitarian ideas. Let us be honest and admit that the alleged equality among men is at best a fiction whose main merit lies in its convenience for use by the legal trade and the politicians. There never has been, and never will be, any equality among men, except in the most superficial sense.

Actually, the philosophy of the Ancients, which is the only time-tested one, knows no egalitarian concepts. A Roman tenet states that, when two men do the same thing, it is not necessarily the same thing. The equality concept only appeared in the writings of the precursors of the French Revolution. I question that even in those days the authors of the egalitarian doctrine took it seriously, although they were well aware of its eminent suitability as a politicial tool.

However, to come back to our original topic—by the time a man has reached age 65 he should be able to decide for himself what he wants to do. He will by that time certainly have got tired of regimentation. You cannot force a man to abandon his chosen life work, and at the same time pontificate about personal dignity and individual liberty. Let's be practical—even a man of 65 has to live. What do you propose he should do, in a time of progressive inflation? In the average case, he'll have to work —or else. I take it that you do not seriously propose that he exist on the government dole, or do you? If ever you find a politician successfully subsisting on that amount of money, wire me collect. —NAME WITHHELD

• *Paraphrasing George Orwell in Animal Farm:*
"All men are created equal; maybe some are just more equal than others."—Ed.

Voice of the Peepul

To the Editor:

Thanks for the reprints of "Why We Need to Know" (Dec. 16, '57, p. 24). For a third of a century I have been shouted down, kicked in the teeth, etc., etc., by the articulate and vociferous Humanists who know little, understand less, and care nothing about Science, Research or Engineering. Resentment on that score, and rage at the situation in which this country now finds itself, oozes from my every pore!

Now that the Peepul have begun an agonizing reappraisal, they are momentarily listening to the things which Killian and DuBridge and Conant and V. Bush and others have been pointing out for so many years. But they listen only momentarily, and turn back to the TV set, or to admiration of Presley, Jackson Pollock, Francoise Sagan, Clyfford Still and e. E. cuMmiNgS and the multi-finned, multicolored, chrome-plated, wasteful piece of junk in the garage.

They listen only momentarily. The problems are difficult to think about, and too unpleasant.

They must be reminded. I am setting myself up as a one-man Fifth Horseman. In my own small circle, I am going to ride about with spikes and cleats of Reality on my horse's hooves. I may have to knock in some teeth with a mailed first. But I will remind the Peepul, again and again. In doing so, I may lose some friends, or half-friends. If this be the issue which parts us, they can be spared. But I will remind them.

When I have calmed down a little I am going to put the bite on some people to contribute to scholarships at Cal Tech. I may thus lose a few more friends. But if I can help substantially to put some good BS through to a Doctorate it might be worth it. . . —BRUCE BURNS
Consulting Engineer

American ...

DEVELOPMENTS TO WATCH...

Metallorganics are heading for the limelight . . .

. . . though this group of compounds has more claim to longevity than novelty (some have been known for years). But the term itself is only now coming into general use, and many of the compounds it covers are both new and newsworthy.

"Metallorganic" (or "organometallic") is a catch-all label for carbon-hydrogen compounds containing metallic groups. Among them are the "high energy" fuels and catalysts used in making the new high-density plastics.

Now that they are in the research spotlight here and overseas, new developments can be expected at a rapid pace:

Tributyltin compounds look interesting as germicides and detergents.

A new antiknock compound, said to be the most promising since the introduction of tetraethyl lead is a manganese metallorganic.

Alkali-metal compounds also look extremely promising—for such diverse uses as fire extinguishers and pyrophoric fuels. Among the latter are triethyl aluminum, trimethyl aluminum, and triethyl boron.

High-temperature aircraft tires . . .

. . . that won't need insulation or refrigeration to protect them against supersonic heat are the goal of a US Rubber research program. The company is building tires of such combinations as wire-reinforced silicone rubber and testing them at storage temperatures as high as 500 F. Both USR and Dow-Corning, which supplied *Silastic* rubber for experimental tires, emphasize the program is still in its early stages.

Window glass that stands high temperatures . . .

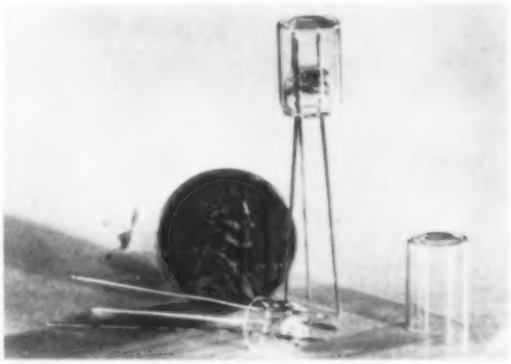
. . . is needed for furnaces and test instruments; and, in supersonic planes, it's just about as important as heat-resistant metals. Yet, says the Air Materiel Command: while today's glazing materials are satisfactory for aluminum-skinned planes, there is no glass designed to be used with stainless steel and similar materials." The AMC has a formula for a glass suitable for 800 to 900 F but it is not in production. Information on the project (7-654) may be obtained from MCPBMM, Wright-Patterson AFB.

5.4 million women . . .

. . . almost half over 45, and 2.2 million men over 45 will be added to the labor force by 1965, predicts Secretary of Labor James P. Mitchell; and these will be, to a large extent, unskilled workers. In contrast, there will be almost no change in the 24-45 age group from which most skilled workers are drawn. The implication for machine designers is clear: A high premium will be placed on machines that can be serviced and repaired as well as operated by semi-skilled employees.

New sealing process . . .

. . . that brings glass to 1800 F while holding semiconductor inside it to −230 F, opens the way for glass-enclosed transistors like the one shown here. Corning Glass Works developed the process, and is introducing a 200-mil-lead circle-enclosure for low-power units this month. Other sizes are to be made available in the near future.



Hermetically sealed in 10 sec, glass tubing (right) forms enclosure for transistor (center).

American...

(continued)

DEVELOPMENTS TO WATCH...

Hard-clad rolled steel . . .

. . . may soon reach the commercial market, says Lukens Steel Co. It is rolling steels clad with four tough metals: Hastelloy B, F, C and titanium; and believes the first two at least have reached the point where potential commercial applications can be discussed. The other two, Hastelloy C and titanium-clad steel, are still in the development stage, but Lukens engineers say they're ready to answer inquiries on properties and possible uses.

As with most clad materials, these are expected to offer "the qualities of the costly solid material at a price significantly below that of solid materials of comparable gage." (For more information on titanium-clad steels, see *PE*—Sep. 16, '57, p 111).

Improved ceramic electron tubes . . .

. . . are under test at General Electric. About half the size of the miniaturized units unveiled two years ago, these new models are discs barely ¼ in. in dia. and ⅛ in. thick, made of alternate layers of titanium metal and a special clay. Designed for operation at 900 to 1500 F, they take advantage of the ambient temperature in that they contain no heater element. "All the heat necessary," say GE researchers, "is provided by their environment." GE emphasizes that the design is still in the lab, and no tubes are available commercially; but GE notes proudly that this development "brings the electron tube, once bulky and fragile, down to the size of its competitor, the transistor" (see p. 5).

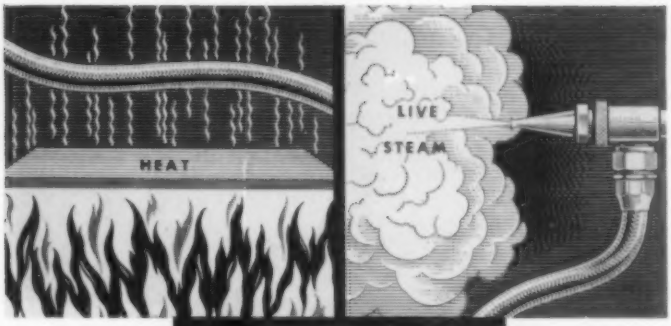
Ceramic and powder-metallurgy techniques . . .

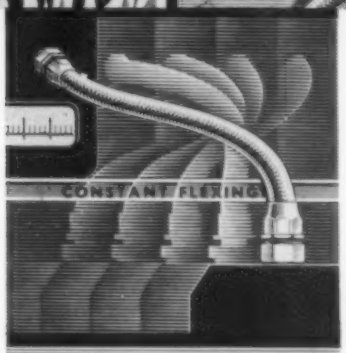
. . . are being pressed into service to provide fuel elements for new-type nuclear reactors. Fuel-element fabrication, a major factor in nuclear-power-plant costs, is being attacked from many directions. The photographs here show a process developed by Atomics International to produce fuel elements for OMRE (Organic-Moderated Reactor Experiment).

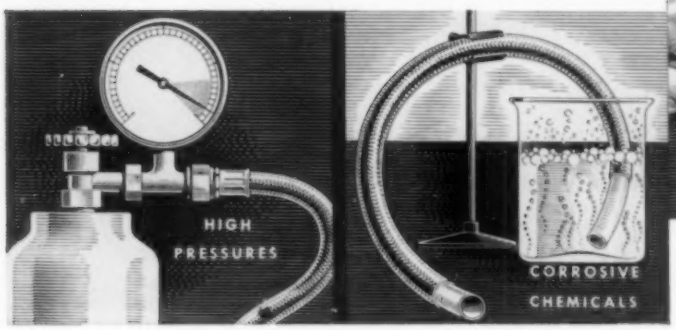
Use of uranium in the oxide form, plus stainless steel powder, to form the core of the fuel element, and sandwiching this core between stainless-steel plates provides an element that is considerably more stable under heat and radiation than the conventional metal types. Plate-type sandwiches used here also facilitate heat transfer. (For more information on reactors and atomic energy problems, see *PE*—Apr. 14, '58, p 52) —ARG

Uranium oxide and powdered stainless steel are compacted in special hooded press to form fuel-element core at Atomics International Div., North American Aviation.

Powdered core is then placed between stainless steel plates, and sandwich is rolled to size (a 10-fold reduction in thickness, achieved by hot and cold rolling).







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Brighter picture, greater contrast. Even this dimly illuminated underwater scene "gains" depth and detail when pictured on monitor (inset) of super-sensitive new TV camera made with nickel-containing metal shield.

How nickel sharpens the "eye" of the military's new underwater TV camera

At the bottom of the ocean, it is hard enough to see with your naked eye.

For the "eye" of a TV camera–the image orthicon – it was out of the question . . . until Admiral Corporation put its designers to work on an extra sensitive instrument for the Armed Forces.

They worked out a special system of circuits that "magnify" the light the camera receives. But stray magnetic fields set up by these circuits wandered, interfering with the camera's operation.

To overcome this interference, Admiral's engineers built a shield of a special nickel alloy called MuMetal* around the image orthicon. This alloy, (77% nickel), possesses high magnetic permeability. In effect, it provides a magnetic path-of-least-resistance which detours these stray fields away from vital parts of the equipment.

The result is a TV camera that can "see" as much by the flicker of a match as a man with 20/20 vision sees by the light of a 150-watt bulb!

And because the camera must be able to operate under water, it has nickel-plated hardware to provide corrosion resistance. And nickel-containing stainless steel hardware where mechanical strength is needed.

Do you have a metal problem? One that involves magnetism . . . shielding . . . corrosion . . . high or low temperatures . . . fatigue or some other complicating factor? Talk it over with us. We – and nickel – may be able to offer constructive help.

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DEVELOPMENTS TO WATCH...

A new third-stage rocket . . .

. . . will be used in Navy's future Vanguard shoots. It is being built by the Allegany Ballistic Laboratory (Hercules Powder Co.), Cumberland, Maryland.

Both Allegany and Grand Central Rocket Company, Redlands, California, had contracts to build solid-fueled third-stage rockets for Vanguard. Grand Central's rocket came along faster, but Allegany's promised to be more powerful.

For this reason, Navy kept pumping money into the project. Now, Allegany's rocket is reported to be ready. The Navy won't say however how much more powerful the Allegany rocket is. From now on, the chances are that the Navy will alternate the third-stage rockets in its future Vanguard firings.

There are seven more Vanguard shoots slated before the end of the year. But, the Navy isn't putting out a time schedule for them. Now that it has the small 6-in. test ball in orbit, there is considerably less pressure on the Vanguard scientists.

Although the next Vanguard shoot is officially labeled as a test firing, it will carry the first 20-in. fully instrumented satellite. Then, subsequent firings will be with instrumented balls.

The final firing of the Vanguard will carry a 13-in. satellite that will eject a 30-in. inflatable ball that is also expected to orbit.

Federal outlays for basic research . . .

. . . are getting a boost by Congress. In a major expansion, a House Appropriations Subcommittee has approved $115-million in National Science Foundation spending plans for the year beginning July 1, 1958—nearly triple the agency's present record budget. The Foundation had asked for $140-million; nearly all of the $25-million denied by the Subcommittee was to help colleges buy costly equipment, computers and the like. The Foundation hopes that at least part of this sum will be restored by the Senate.

The $115-million includes $107-million for basic research grants and contracts in science, math and engineering; high school science-math teacher training programs; and pre- and post-doctoral university fellowships. Another $8-million was set aside for new programs. The higher budget will permit the Foundation to about double its support of basic research, which is a $16,250,000 item in this year's $40-million budget.

Until now, the Foundation has been able to support only one-third of the "meritorious research projects" for which scientists have sought funds. It should be able to improve on that record next year.

Fresh water from salt . . .

. . . or brackish water head the list of programs being pushed by western states congressmen. Before Congress are bills to put up $10-million to finance sizable plants to test several processes on a scale larger than ever attempted before. Chances of getting such bills through this Congress are picking up, despite some industry opposition to getting into a large-scale demonstration plant program before more basic research has been done on the various saline water conversion processes.

First action is expected from a Senate Subcommittee headed by Senator Clinton Anderson (Dem., N. Mex.) which held a two-day hearing last month on bills to use $10-million to build two plants—one for converting sea water to fresh water and the other to de-brine inland brackish water of lesser salinity than sea water. But, Senator Clifford Case (Rep., S. Dak.), who with Anderson, has introduced such bills, showed signs of backing down after hearing industry testimony. Case said he now favors spreading the money among more numerous, but smaller pilot plants.

The subcommittee, expected to act soon, also heard Rep. Clair Engle (Dem., Calif.) hop on the administration for its lack of urgency over threatened water shortages. Also, a California official warned that his state will need distilled sea water in "five to eight years." Engle has a bill providing for a $20-million plant in Los Angeles, financed jointly by the US and California, and using "waste" steam from local utilities to lower water conversion costs. So far, the most promising processes, he says, are the multiple-effect distillation method of W. L. Badger (Whiting Corp.) with a sea-water conversion cost of 50 cents a gallon, and a similar process of Maxim Silencer Co. with a 68 cent/gal. cost.

World-wide ...

DEVELOPMENTS TO WATCH...

Pointers for belt design . . .

. . . come from a continuing study of conveyor belts at Hannover Institute of Technology in West Germany. Static tensile strength, Institute researchers point out, is often used as a gage of conveyor belt life, and there is a temptation to increase the number of plies to increase strength and durability. But, says the Institute, this does not take into account the fact that a conveyor belt must withstand repeated bending, and that stresses at the loading point and the point where the belt passes over the roller may be far higher than the figure for over-all capacity might indicate. Thus, a belt may fail even though static tensile strength meets specifications.

Surprisingly, tests so far made indicate that the more rigid of two belts, rather than the more flexible, may be better able to stand bending movements. Further testing is deemed necessary before the flat statement can be made that stiff belts are superior to flexible ones. But these tests do at least show that "when behavior under alternate bending is to be investigated, short-term tests . . . cannot under any circumstances provide reliable criteria for classification."

The Institute also points out that mean values should not be used to evaluate test results of fabric-reinforced belts because "the strength of a system of threads must always be judged on the basis of the weakest members."

Protection for silicon carbide at 3000 F . . .

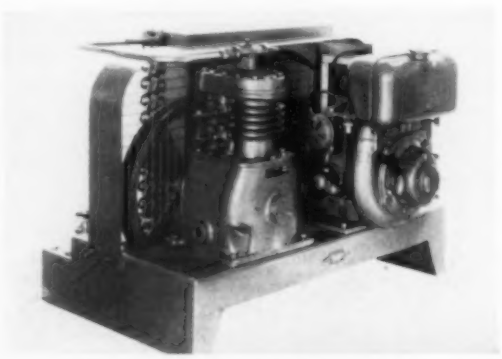
. . . is claimed by West German developers of a new type of coating. Known as *Vanal* linings, these materials, developed specifically for furnace use, are said to take advantage of surface and interface tension as a means of repelling corrosive liquids and gases, and to "neutralize the capillary action in such porous materials as silicon carbide, preventing oxidation without altering heat conductivity." Extremely thin coatings (a few thousandths of an inch) are effective in providing protection for "many years," claims Charmotte-Industrie Hagenburger-Schwalb A.G., of Pfalz, the producer.

A midget pump with a capacity of 31 gpm . . .

. . . against a 200-ft head is being introduced by Holman Bros., Ltd., Cambourne, Cornwall, England. It weighs just 11 lb; and is said to be a continuous, self-priming, self-lubricating, single-stage unit that employs a rotor of "entirely new form to achieve a pumping efficiency better than 60%" and is so designed that all metal-to-metal contact is eliminated. This is achieved through use of a rubber stator and rubber face seals. The rotor is said to be an adaptation of the "screw" of the Archimedes pump—but with an important addition, a rotating plate, which the rotor engages to produce a "pulseless action that is virtually positive." In the 1½-in. size described above, the pump requires a prime mover of only 3.1 bhp. Speed range can be 750 to 3000 rpm.

Gas engine refrigerators . . .

. . . for trucks and stationary installations when power is not available are being introduced by Bitzer Kuehlmaschinenbau GmbH, Sindelfingen/Wuertt, West Germany. According to Bitzer, the gasoline engine provides easy starting, low noise and vibration, and will operate automatically under thermostat control. A gear-and-governor system is designed to maintain an operating level of 1500 rpm.



filtration problems?

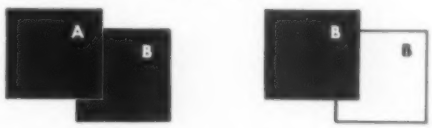
NY-SUL-LOFT*, *the NEW 100% nylon filter material,* MAY TURN YOUR PROBLEMS INTO PROFITS!

Air, smoke, gas, liquids — you name the type of filtration that's giving you trouble and it's very likely that NY-SUL-LOFT can help you. In recent applications, this remarkable new 100% nylon material has proven itself superior to all other filter media on the market. Take a look at the results of a test conducted on-the-job by a leading air purification company:

Before Use

1 Two filter media were placed in operating position, under identical operating conditions. One was an ordinary, widely-used material, (A). The other was new Ny-Sul-Loft, (B). Behind each was placed a second Ny-Sul-Loft filter.

After Use



2 After the usual interval between replacements the outer filters were removed. The piece of Ny-Sul-Loft behind the ordinary filter was black. The one behind the Ny-Sul-Loft was still clean and white!

Make your own tests! You'll find NY-SUL-LOFT's 100% nylon fibers are permanently welded into minute, resilient "springs." That it is resistant to alkalis, acids and other chemicals which do not react with nylon. *Why not take it from there — see how this new material fills YOUR strictest requirements?*

NY-SUL-LOFT is available in standard formulation or can be engineered for your specific requirements.

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What's happening in SCIENCE

Why the confusion on fusion?

Was there, or wasn't there, a thermonuclear reaction? That argument is still going on at atomic-research centers following the first enthusiastic announcements (*PE*—Oct. 21, '57, p. 12) of British and American progress. Says Sir John Cockcroft: "We are 90% certain that the conditions in ZETA (the British accelerator) are those needed for a thermonuclear reaction. Others apparently are not so sure.

The reason for the "argument" is this: At temperatures in the range of 100 million C, there is little doubt that a thermonuclear reaction would take place—and it would be a self-sustaining reaction. But at temperatures in the 5-million-C range, this is not so certain. The neutrons that are observed might be byproducts of a thermonuclear fusion reaction; but they might also result simply from the instability induced by heat and electrical discharge inside the toroidal reaction tube.

Both British and American scientists agree, though, that if a true thermonuclear reaction has not yet been achieved, it will be soon—perhaps with the Sceptre Three thermonuclear torus at Aldermaston, which is expected to reach 10 to 12 million C "in a few months' time"; or with the larger model now being built that's aiming for 30 to 40 million C.

It will still be a long way to controlled economical fusion power, though. Experts agree that in this area we are barely at the stage fission power reached in 1942. Learning to handle the tremendous temperatures involved in thermonuclear reactions, and to harness the energy released, may take a lot longer than most people think. (For a survey of where we stand on fission power, see *PE*—April 14, '58, p. 52.)

Ideas from coal

Increased knowledge of combustion processes, handling methods for bulk materials, and a host of other techniques, can be expected from a new coal research center soon to be established in Pittsburgh. Result of a cooperative program of the coal industry, the new center, to be operated by Bituminous Coal Research, Inc., will study coal preparation, its use as fuel, and chemical byproducts.

briefs . . .

Thermonuclear research is being pushed in West Germany too. Researchers at Aachen are said to have achieved million-amp currents and temperatures of 200,000 C "for at least a millionth of a second"; are now designing bigger and better equipment for a new Institute for Hydrogen Fusion, to be built at the Juelich Atomic Center. Fusion studies are also under way at Hamburg, Goettingen, and Kiel.

Ion propulsion, free radicals, and magnetohydrodynamics are among the topics to be discussed at the SAE National Aeronautic Meeting, April 8 and 9 in New York. For a brush-up on these advanced propulsion systems, see *PE*—Sep. 23, '57, p. 17; Oct. 7, '57, p. 15; Feb. 24, '58, p. 14.

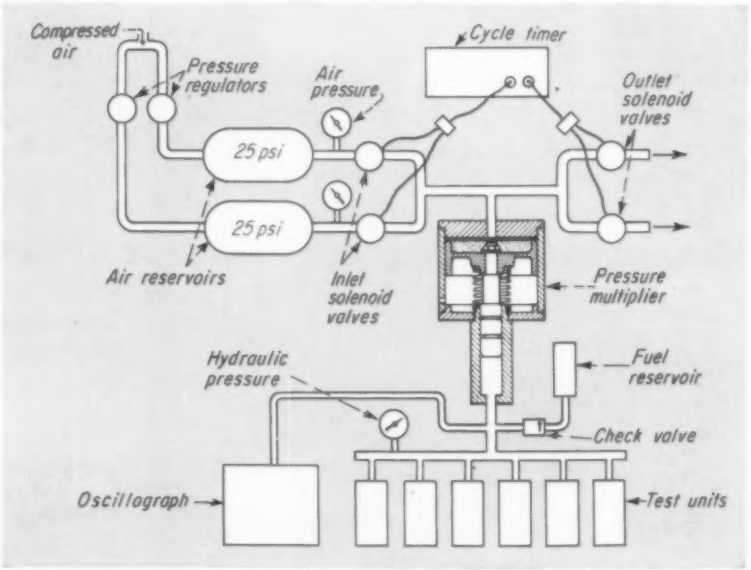
Irradiation services aplenty are available in private industry, says AEC, and it's getting out of the business. At least 16 industrial and university laboratories are now equipped for subjecting test parts to isotope radiation. Irradiation time on high-energy machines is also open for industrial use (*PE*—Feb. 17, '58, p. 17). —ARG

Fast build-up

AiResearch engineers needed a test rig that would build hydraulic pressure from 0 to 450 psi in $\frac{1}{10}$ sec—and drop it back down just as fast.

Object: to test the ability of new oil-temperature regulators to withstand sudden, unexpected surges of fuel.

Solution: The system diagrammed here. Solenoid valves control release of air against pressure-multiplier piston, which has a top surface of 20 sq in. This in turn, exerts pressure on piston extension, which has a one sq. in. surface, developing the needed 450 psi and applying it to the hydraulic-fuel system that feeds the units under test. Timing system uses cammed discs acting on microswitches, and the oscillograph is tied in to check over-all accuracy.



Glassed plastics tackle new jobs

Heavy-duty valve seats, tie-down rings for electric motors, and shock-absorbing foams point up the engineering possibilities of new glass-plastic combinations.

Announcing the results of experiments with urethane foams, National Aniline Div. of Allied Chemical and Owens-Corning Fiberglas say foam resilience, compression set and compressive strength "may be noticeably increased, and per-cent elongation reduced," by adding glass fibers to the foaming mix. By varying the fiber length and coating, it's also possible to engineer the foam for specific uses. For instance, "when high-hysteresis losses are desirable, as in impact cushioning, they can be achieved by adding 5% of ½-in. milled glass fibers to the foam. Compression strength will be high . . . and the material offers sustained resistance and rebounds slowly, making it an excellent shock absorber."

The tie-down rings, developed by Pittsburgh Electrical Insulation Co., and now under test, replaced steel bands ⅛ in. thick, previously used to keep motors from tearing themselves apart under heavy surges. The glass fiber-resin rings are said to provide high strength and electrical insulation.

In the flush valve pictured above, which has a one-piece glass-coated head and stem, a glass-filled Teflon (TFE–fluorocarbon resin) provides long life and smooth operation. The manufacturer says the price is comparable to that of stainless steel.

(For information on another new development in glass-fiber plastics, see "Sprayed Reinforced Plastics, *PE*—*Jan* 13 '58, p 17).

Glass and plastic work together in this Pfaudler valve, giving it a seamless, corrosion-resistant interior.

New hope for polished metals?

Polishing need not deform metal surfaces, Australian metals researchers believe. They think it's high time the old Beilby-layer theory was challenged.

It has long been thought that polishing smooths out hills and fills in the valleys by coating the surface with a thin layer of structureless metal—the Bailby layer.

But the Commonwealth Scientific Industrial Research Organization now thinks this structureless layer is just a result of poor polishing technique—not an essential of the process. Experiments with single silver crystals show it is possible, using extremely fine-grained abrasives, to prepare highly polished metal surfaces with little or no deformation, and no evidence of a Beilby layer.

briefs . . .

Closer control of stainless bar stock for such applications as steam-turbine blades, valve and pump parts, shafting and micrometer components, is promised by new Jones & Laughlin heat-treating line. The company says the new line will "make it possible to supply types 403, 410, 416, 431, 420, and 440 in a close range of hardnesses to meet specifications."

More selenium can be recovered from nickel ores with a new electrorefining process, International Nickel Co. reports. It's a process in which nickel sulphide of low copper content is cast directly into sulfide anodes for electrolysis. This bypasses the conventional high-temperature oxidation and reduction steps, and makes it possible to recover substantial amounts of both sulfur and selenium.

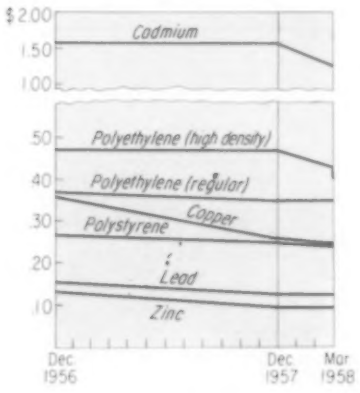
Radiation-resistant adhesive, developed by California Stucco Products of New England, Inc., has passed its first big use-test, the company reports. First use was as a replacement for conventional mortar in building radiation-test vaults at High Voltage Engineering. Now, its unusual properties are expected to find its applications even outside the radiation field. It's a vinyl-based adhesive that has good compressive and shear strength and low enough tensile strength to permit disassembly of blocks without damage.

—ARG

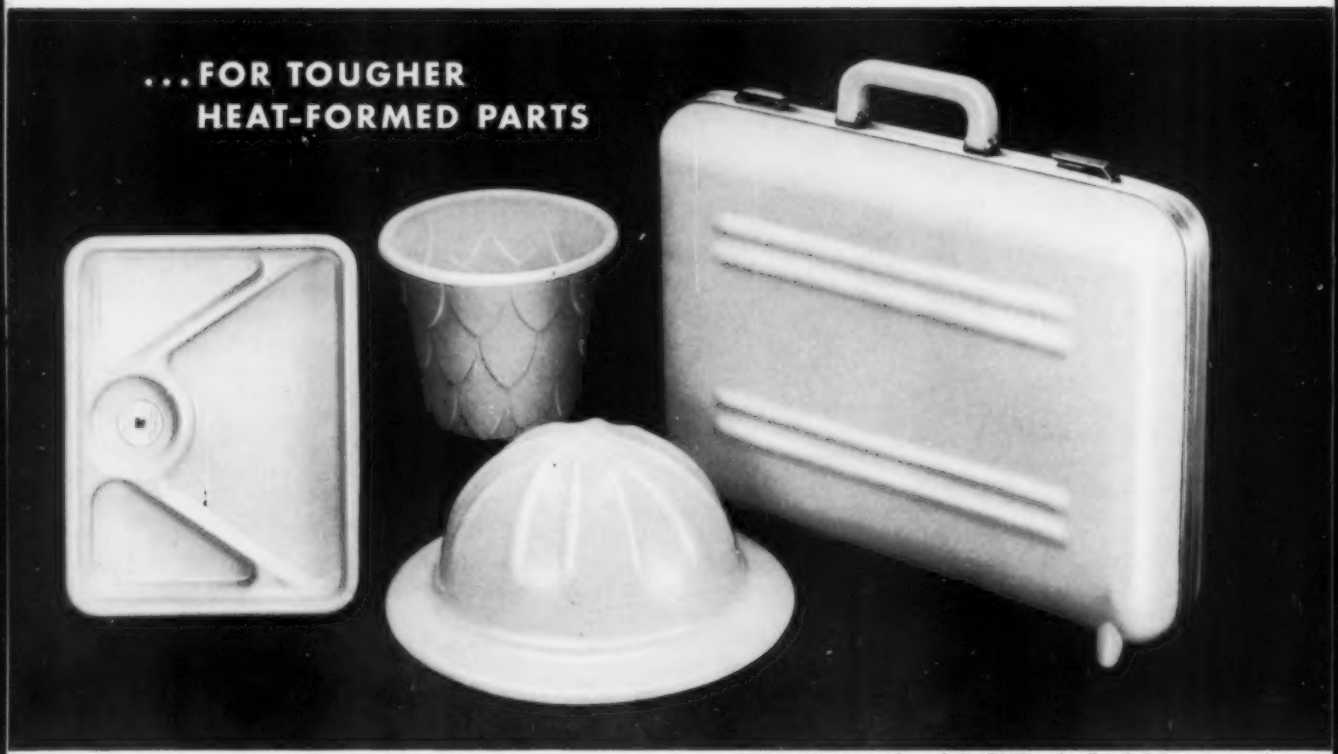
How cost patterns are changing

In the past few months, one basic material after another seems to have topped the peak and started on the downgrade. Following the pattern set last year by copper, lead, and zinc, minor metals like cadmium are beginning to slip. Prices of two major plastics have been cut, too, as the chart shows. But many industry leaders predict an upturn—perhaps to start in the second quarter. It might be a good idea to watch and wait before making major materials shifts.

Materials Price Trends



Announcing TYPE 2



*MARLEX is a trademark for Phillips family of olefin polymers.

PHYSICAL PROPERTIES OF MARLEX

	NEW TYPE 2	TYPE 9	TYPE 15	TYPE 35	TYPE 50
MELT INDEX	0.2	0.9	1.5	3.5	5.0
IMPACT STRENGTH ½ x ¼ inch bar ft-lbs/in notch	14.0	4.0	2.5	1.5	1.2
ENVIRONMENTAL STRESS CRACKING Bell Laboratories Test, F_{50}, hours	60	14	10	2	1
BRITTLENESS TEMPERATURE 50%, °F	<–180	<–180	<–180	–150	–100
ELONGATION %	30	25	20	15	12
DENSITY	0.96	0.96	0.96	0.96	0.96
SOFTENING TEMPERATURE °F	260	260	260	260	260
TENSILE STRENGTH 20 in. min, psi	4400	4400	4400	4400	4400
STIFFNESS psi	150,000	150,000	150,000	150,000	150,000
HARDNESS Shore D	68	68	68	68	68

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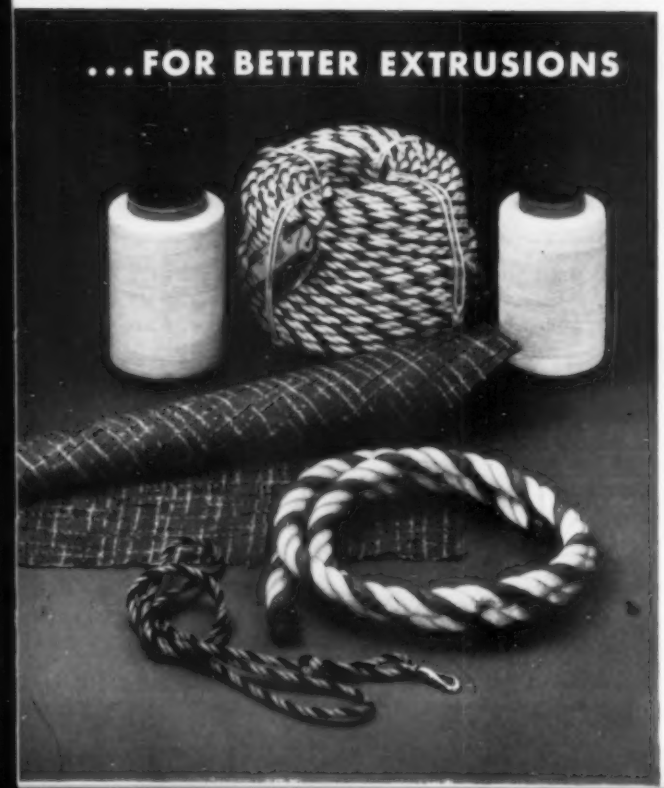
RIGID
POLYETHYLENE



A new addition to our line

Type 2 MARLEX is a new low melt index extrusion-grade resin now available to plastics processors in commercial quantities. Compare the data on the five types of MARLEX. See for yourself the advantages Type 2 offers you for vacuum forming, blow molding and extrusion applications—greatly increased toughness . . . higher impact strength . . . improved resistance to environmental stress cracking . . . higher melt viscosity . . . better creep resistance.

If you vacuum form parts, you will appreciate the high melt strength of this new resin type because it minimizes sag. Large sheets are accurately formed with uniformly thick walls even in deep draw applications. The high melt viscosity of Type 2 MARLEX is also very useful if you extrude or calender sheet.

Greater creep resistance of Type 2 MARLEX improves products made with extruded filaments, such as rope and seat cover material. And its increased resistance to environmental stress cracking is tailored for blow molders and extruders making bottles and tubes for packaging foods and drugs.

If you would like a bulletin with further information on Type 2 MARLEX resin, please send coupon below. Or call your nearest MARLEX office.

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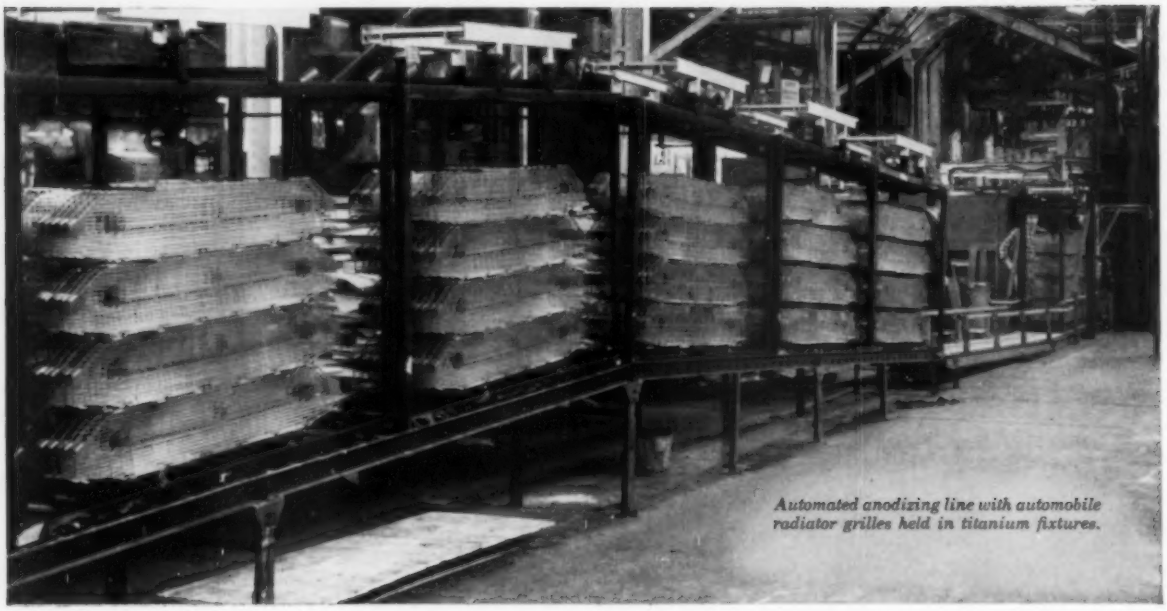
Progress with **TITANIUM**

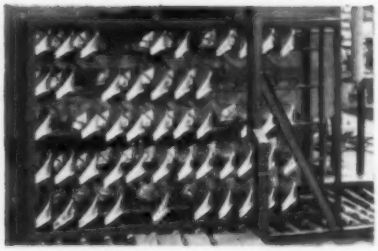


Automated anodizing line with automobile radiator grilles held in titanium fixtures.

TITANIUM LASTS 20 TIMES LONGER

in this anodizing process

Close-up of moldings held in titanium tips on anodizing rack.



Headlight assemblies held in titanium fixtures.

This automatic anodizing line at Reynolds Metals Company, Louisville, Kentucky, handles aluminum automotive parts on a huge scale. Parts such as window frames, grilles, hood moldings and headlight assemblies, are mounted on racks, which are first dipped in a brightener solution (highly concentrated sulfuric and phosphoric acid), then into an electrolytic bath.

What metal should be used to make the racks? Typical rack life at Reynolds was only 6 days on one anodizing line until titanium was tried. Average rack life is now *120 days.*

For economy in construction, the basic racks are made of aluminum, which is rubber coated. The rack tips or holding fixtures, which must be left bare, are made of Mallory-Sharon commercially pure titanium, riveted or welded in place.

Titanium in this mass production operation yields substantial savings, prevents the disruption of constant replacements. Let us help *you* evaluate titanium wherever you have the problem of corrosion. Write for booklet listing titanium corrosion-resistance data.

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Integrated producer of Titanium • Zirconium • Special Metals

What Better Mousetrap?

Emerson is said to have disclaimed that familiar quotation about designing a better mousetrap. There's good reason; it really represents nothing but a lazy man's way to get a doorpath beaten.

There is no ingenuity, no origination, in *improving* a mousetrap. This approach automatically rules out alternate solutions which are *not* mousetraps but may be a good deal better.

What about ways to electrocute, drown, gas, or poison the mouse? What about just scaring him to death—a truly painless method? And what about a plan for utilizing mouse fur or mouse meat? Or, what about long-term planning that envisions our own food in cans, packages or even pellets that are rodent proof? This could conceivably make the mouse a smaller and more-economical alternate to the dog as a household pet (or pest, if you prefer), and even create a market for prepared mouse food.

We're talking here, of course, about the new idea, the breakthrough into a really ingenious solution for the problem. The better mousetrap is only a pedestrian answer, the perfecting of an existing design that characterizes the routine approach.

Ingenuity does not flower in improving or refining, in group brainstorming or elaborate laboratories, or even as the inevitable product of advanced training. It is normally the child of necessity, the inspiration of the man who has to make do without.

Hall found a practical production method for aluminum in his kitchen; Goodyear learned to vulcanize rubber by spilling a gooey mixture on the kitchen stove. Rutherford worked out the diameter of the nucleus with less than $10 worth of equipment you can buy at any hardware store. Wilson's cloud chamber cost less than $10 too. The examples of breakthroughs like these are endless.

The new idea comes from the uncluttered, open mind concentrating on a problem. The valve gear was invented by a boy tired of operating valves by hand. Melting ice to lower a huge machine into an impossible spot was a solution born of desperation. Reducing the air pressure in truck tires so the truck will clear a viaduct, or having a dog with a string on his collar chase a cat through a long bent pipe are simpler examples of the same clear thinking. They attack the problem directly—which the fabled mousetrap improver didn't do.

It's well to remember that history does not pay off on effort, but on results.

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Your decision for International, for example, will please your sales manager. He knows International needs no pre-selling to customers, that this famous heavy-duty power is as dependable as it is economical.

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Likewise, your purchasing agent knows he can get very special delivery service on International power to prevent any production delays.

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Monorail: Safety, Speed and Silence

- **Efficient transportation in some countries, a tourist attraction in the US, is still under consideration by several large cities.**
- **For comfortable riding: pneumatic, steel-cord tires.**
- **Lightweight metals and plastics, plus aerodynamic design, permit top speeds of 75 mph.**

LOS ANGELES—Recent advances in materials, propulsion, and lightweight construction are filtering into design of overhead monorails, and slashing size, weight and costs. Decreasing costs are increasing interest in putting monorails to work moving passengers through dense urban areas.

Monorails have many advantages: they are fast, quiet, safe; they can climb steep grades; and they arch over rather than tunnel under today's overcrowded streets. Add the fact that first cost is roughly comparable to an elevated train, substantially less than a subway and it is easy to see why city planners are eyeing airspace for a way out of their public-transportation problems

SET SAFETY RECORD

Monorails got their first tryout on a 7.5-mi installation (the Wuppertal) connecting Barmen and Elberfeld, Germany. The line is still operating (claiming a safety record tarnished by only one suicide) and carries some 17 million passengers a year. Most other monorails operating today are novelties or experiments. Tokyo has just opened a 62-passenger twin-coach system for sightseers in its Ueno Park. A ½-mi prototype built by Monorail, Inc. is operating in Houston, Tex., and paying its way as a tourist attraction.

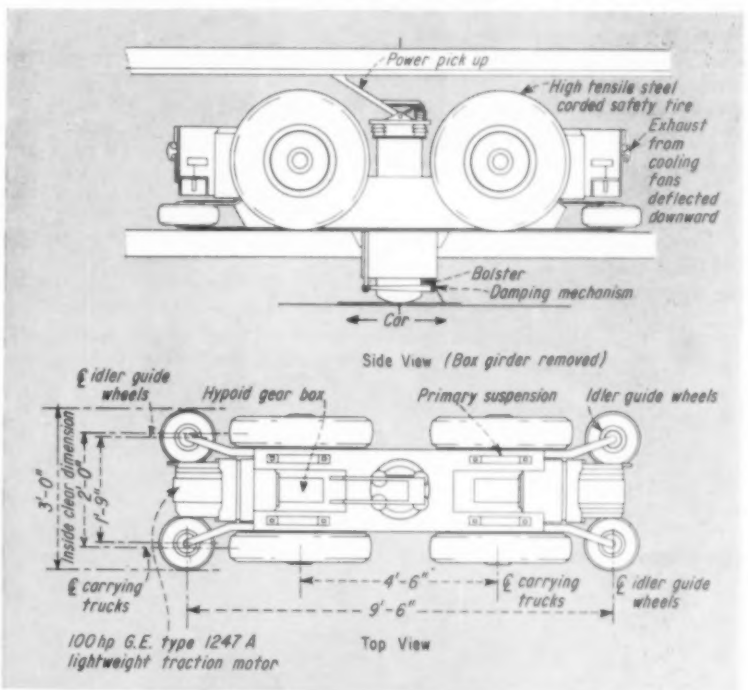
Monorail is presently under consideration as an integral link in the transportation networks of San Francisco, Los Angeles, Caracas, and London. The London system is proposed to shuttle passengers between the city and its airport—an innovation that would cut travel time in half.

The system under consideration in San Francisco was designed by the architecture and engineering firm, Daniel Mann Johnson and Mendenhall. DMJM has designed many types of public transportation facilities including highways, harbors, airports and mass rapid-transit systems. The monorail setup they submitted to San Francisco for consideration is 8.7 mi long with 1.5 mi of access and storage tracks. The 8.7-mi nucleus can eventually be expanded to 30.1 mi as construction funds become available. DMJM estimates the original stretch will cost $37.2 million. The estimate includes stations, towers, right-of-way, power supply, monorail cars, personnel training and a host of auxiliary expenses that go with getting the system into operation.

Here are some of the technical features which would be included in the proposed San Francisco system:

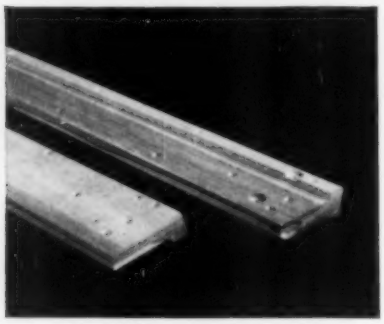
Supporting towers to carry monorail cars and tracks are spaced at 90-ft intervals. Each tower is constructed of two structural steel T's that rise at an angle from a common base. (Viewed head-on, the towers resemble a T; viewed from the side, a V). The towers were tilted to better absorb the lateral forces of the trains as they stop and start. The lateral forces are transmitted to the legs of the V and carried to the footings, thereby preventing the structure from turning over. Structural steel was chosen over concrete because it minimizes overhead dead weight and reduces over-all size of the structure. Base of each tower is planted in a 4-by-2 ft rectangular area in the center of the street.

The tilted-T tower is not best for all situations. Vertical T towers are sometimes used at the ends of switch sections and on curves. Gantry towers are generally used to span canyons or fit in very narrow streets. These towers are actually two arches that extend



Design for monorail trucks proposed by Daniel Mann Johnson & Mendenhall

WHAT'S YOUR WOOD PROBLEM?



Gamble research helps improve CONVEYORS!

THE PROBLEM. Conveyor deflector bars have to be tough enough to withstand the repeated impact of conveyed objects. If they're not, the bars break in the middle or split horizontally. In either case, the result is production equipment downtime as well as maintenance expense.

THE RESULT of Gamble testing and development: a laminated hickory deflector bar that is actually thinner than the old solid-wood "problem" bars. Lamination assures *more uniform* strength (little chance of weakest parts of individual pieces lining up). Hickory assures *greater* and *more consistent* strength. New thinness assures *greater resiliency.* They all add up to longer conveyor life . . . less time spent in downtime for repairs. Perhaps Gamble could help with *your* wood problem.

Send for FREE booklet Illustrating GAMBLE services

This 28-page booklet describes Gamble facilities and services in detail. Includes many photographs of unusual products designed, tested and perfected by Gamble Brothers. Write for your copy today! Gamble Brothers, Inc., 4617 Allmond Avenue, Louisville 9, Ky.

GAMBLE BROTHERS
Incorporated
Louisville 9, Kentucky
If the problem involves WOOD —GAMBLE can help!

over the street. Bases of the arches are joined at the side of the street; the arches rise from the base in a V.

Wheels and propulsion system of the monorail cars are wrapped inside a girder with a 4-ft-sq cross-section that runs the length of the line. The girder has a continuous slot on the bottom side to provide space for linking the wheels to the body of the car. The girder is made of fabricated steel plates and small, rolled, structural shapes.

Each car rides on two trucks or "bogies," each with four pneumatic wheels that are tied in with the propulsion system and two pair of rubber tired wheels that guide the unit. The pneumatic tires are built on high-tensile corded steel. The wheels are set on tandem axles mounted on steel H-frames. Each set of wheels is equipped with disk brakes, a motor and drive unit. By tying wheels at both front and back of car into the propulsion system, the designers have used the entire weight of the car to aid traction.

Driving power is supplied by 100-hp electric motors through hypoid drive gears. Because the pneumatic tires are nonconductors the rails are not used as part of the current-carrying system. Current is carried by N 6/0 grooved overhead copper wire, and is 600-volt dc.

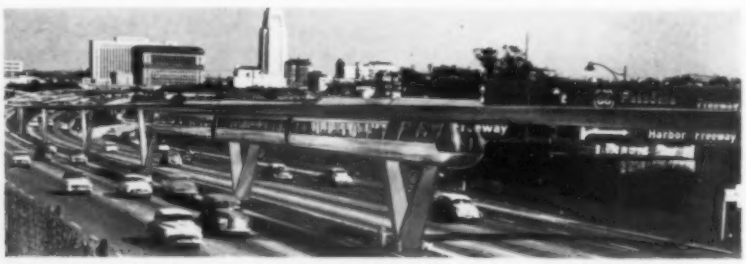
Smooth ride for passengers is made possible with primary and secondary suspension systems that isolate the truck frame from the axles to absorb sudden longitudinal shocks. The primary system consists of rubber compression units. The secondary system has a helical bolster spring and rubber shear-compression ring that act in parallel. The rubber unit, a truncated ring, is centered axially around the truck bolster pin. It absorbs the spring thrust through a combination of shear and compression. It also helps to reduce noise, and give a damping action to the bolster spring.

Monorail car design is based on aerodynamics; the cars are made of lightweight metal alloys, plastics, and fiberglass, and are built much like airframes. Outside shell of the car is shaped to have minimum drag and "zero" lift. The shell is a sandwich of corrugated aluminum alloy and flat sheets that are riveted or welded into shape. The roof and sides of the car are insulated with fiberglass; the floor is a steel deck with linoleum covering.

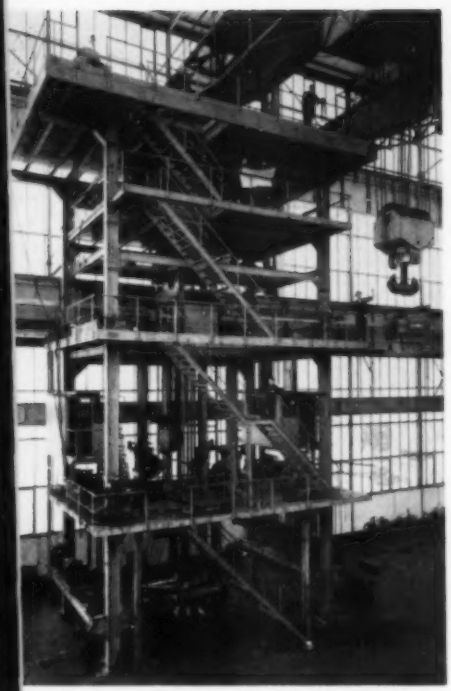
Load on the car's skin is distributed by transverse ribs contoured to the cross-section of the car. A structural beam runs the length of the roof beneath the ribs. It provides support for couplers and car wheels and reinforcement for the axial loads of around 100,000 lb that are created when cars are coupled or uncoupled. The cars are 64 ft long and will carry 100 passengers—68 seated, 32 standing.

Automatic electronic equipment controls the spacing of individual trains, slows cars to a safe speed on curves, and stops, starts and positions them in stations. Human participation in the train's nervous system is limited to a central dispatcher and a man at the control console of each train's lead car. The operator manning the lead car and the dispatcher can contact one another over a telephone and ultra-high-frequency radio, and in the event of electronic failure take over control of the train from the automatic system. Under normal conditions, the operator monitors a console that signals its mechanical instructions with lights and buzzers.

The trains run on 90-sec headway and on straight-aways can sometimes reach speeds of 75 mph. On a curve with 1000-ft radius max safe speed is 60 mph, and on curves with 250 ft radius—a sharp turn at a city street intersection—max speed is 15 mph.



Artist's conception of monorail as it might be applied to Los Angeles Freeway.



Eight billets of steel . . . simultaneously flow from German-designed continuous-casting plant rated at 180,000 to 200,000 tons annually. The plant is headed for Terni, Italy.

Germans Develop Fast-cast Steel Plant

BONN—A continuous-casting steel plant that spouts eight billets simultaneously, 9.8 ft long, in 4.3- and 5.5-in. sq sections has been designed by Demag AG, Duisburg, Germany. Rated annual capacity is 180,000 to 200,000 tons.

The eight billets can be fed from an open hearth or electric furnace. One 60-ton open hearth can feed all eight strands; a 30½-ton electric furnace, four strands. Steel is poured by ladles that shift, tilt hydraulically.

The eight casting positions are arranged in two groups of four each, both groups controlled by apparatus on top of the 51-ft high, self-supporting structure. Steel is cast into oscillating, water-cooled molds. Mold oscillations are set between 0 and 1 in. between 30 and 100 cycles per min.

Pinch rolls driven by electric motors and positioned hydraulically grip the solidified bars as they come from the molds and press them toward the base of the structure in a continuous ribbon. A remote-controlled oxyacetylene torch cuts bars to lengths, specified for the run. As bars are cut, they are gripped by hydraulic tongs that transfer them to a receiving device, which carries the bars to a roller conveyor.

Automation Boosts, Cuts Russian Costs

LONDON—Automation has not always lived up to expectations in Russian industry, says Soviet economist, Professor Zvorykin. But hopes are still high. Case in point is a piston-ring factory recently fitted with automatic instrumentation. Workers in the revitalized plant were expected to turn out 21.1 parts an hour, a sharp increase over the 7.6 parts produced in a non-automated plant. Actual production: a disappointing 8.2 parts.

More serious, production costs rose with automation. On paper, the pistons were expected to cost 7.17 roubles each. In practice they cost 13.66 roubles when first production runs were made in 1953. Cost was shaved to 9.46 roubles by 1955, but is still above production costs in a non-automated plant.

In some other areas, the economist says, Russian industry has recovered its investment in automatic equipment. Remote control of scraping operations at Degtyarsk ore mine cost 8.2 million roubles and was recovered in 15 mo. Automation of synthetic-fiber production paid off in 7 to 8 mo, copper smelting in 6 to 8 mo, food processing in 15 to 20 mo and synthetic rubber in 18 to 24 mo.

Steering Wheels Made Safer

BONN—A steering-wheel column that telescopes into the steering box when a driver is thrown against the wheel in collisions has been patented by Prof. Porsche, designer of Porsche sports cars.

Telescoping is made possible by a hydraulic core in the center of the steering worm. Vents along the length of the core are arranged so damping action applied hydraulically to the column will increase as pressure on the steering wheel increases.

The innovation is expected to nip a major cause of auto-crash fatalities.

Design Analysis On Fasteners and Small Parts

Shows Cold Heading Usually Cuts Costs

This may very well be the age of "Design Analysis". And, one of the most promising fields for such a cost saving study is fasteners and small parts. Actually one of the most important cost cutting developments in recent years is the increasing use of cold headed parts and fasteners in place of more expensive and structurally weaker screw machine products.

The more expensive bar stock used in the screw machine method results in considerable waste, whereas the waste is almost negligible in cold heading.

Another important consideration is the greater strength structure of parts made by the cold heading method. The blow of the heading tool causes the grain structure of the metal to flow in lines of greater strength.

The possibilities of cold heading are almost unlimited when used in conjunction with secondary operations. The tremendous savings in operation and material costs make it a must consideration when designing small parts either as fasteners or as integral units for manufactured parts. It has been a long time policy of John Hassall, Inc. to support their cold heading equipment with the latest methods of secondary manufacture. Machines for roll threading, slotting, drilling, tapping and many other operations are available for your profit.

Given complete specifications, including a drawing and an idea of the application, we can quickly tell you whether or not it will be advantageous to have your fastener or part JOB-DESIGNED by HASSALL. The remaining important aspect of our service to you is the ability to get into production quickly and make prompt shipment.

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Leipzig Fair Spotlights Soviet Lag in Product Design

LEIPZIG, GERMANY—Judging by the recent Leipzig Fair in East Germany the Communist bloc lags well behind America, and even West Europe, in most product designs.

For example, there was little evidence of miniaturization in home electrical appliances, which are inclined to be bulky with out-dated styling. One reason for this is that state planners, pushing ahead with industrialization at a breakneck pace, usually give top priority to basic utilitarian equipment that can be mass produced with minimum cost. When mounting output targets must be met, it's easier to freeze designs than rethink and retool for a more efficient and better-looking product.

The situation parallels the one existing in West Germany just after the war, when production stress was on products for utility and export. The most careful design then was reserved for export products, which had to earn vital foreign credit.

NO COMPETITIVE IMPETUS

Further, there's no stimulus of competition in the prevailing sellers' markets where most consumer goods are in short supply and factories badly need new machinery.

In addition, "bureaucratic centralism" in industry often creates a big time lag between the drawing board and production lines. East Germany, for instance, had a new small auto in advanced-prototype stage two years ago. But it won't come off the assembly line until late 1958.

Insufficient skilled labor and shortage of certain materials, particularly special metals and sheet steel suitable for deep draws, are other factors. Examples: One East German factory had a running headache with the electric motor of a small heater-ventilator. The plastic bearings swelled with heat and age, making the shaft seize and customers groan. Lack of suitable insulating material causes larger electric motors to be unduly large for their power capacity. These were seen powering East German machine tools and other equipment at Leipzig.

The strength-through-weight philosophy was evident in the construction of some of the Soviet tractors and trucks, whose castings for engine and transmission-components are sometimes massive. Designs of several of these vehicles date back 10 years. Yet mass production continues because of inexhaustible demand and lack of consumer choice. Aside from raising fuel economy there is little incentive to change.

But development is rapid when Soviet planners assign a high priority. Machine tools, like the Sputniks and jet aircraft, have received the nod. Russian broaches, precision grinders and copy millers exhibited at the Fair showed a high standard of both design and execution. A number of the units featured automatic loading and sizing.

When given a free rein, Soviet engineers show their worth also in nonstrategic items. A new hydrofoil boat, on view at Leipzig and claimed to be the first of its kind, employs short, straight-lift blades that do not protrude beyond the hull. These give the 27-ft craft improved maneuverability in confined waters, make it less vulnerable to floating debris, and permit beaching.

Russian design hydrofoil . . .
. . . with room for 6 passengers, has short, straight lift blades that do not extend beyond width of hull, give 27-ft craft maneuverability in confined waters, permits landing on beaches. An 80-hp car engine gives a top speed of 42 mph. New craft is offered for export at about $7,500.

EXTENDED IN CHINA

Russia's emphasis on heavy industry has set the pace for the bootstrap economic expansion of its more backward allies. The formula is carried one step further in Communist China, where factories are now not only tooled up with Soviet equipment but are making many end-products according to Russian designs.

An outstanding example is China's infant machine-tool industry, which displayed a score of its latest models at the Fair—all designated by Soviet-type numbers. Most spectacular as an indication of Chinese engineering growth was an internal centerless grinder with auto loading and unloading, for outer bearing races.

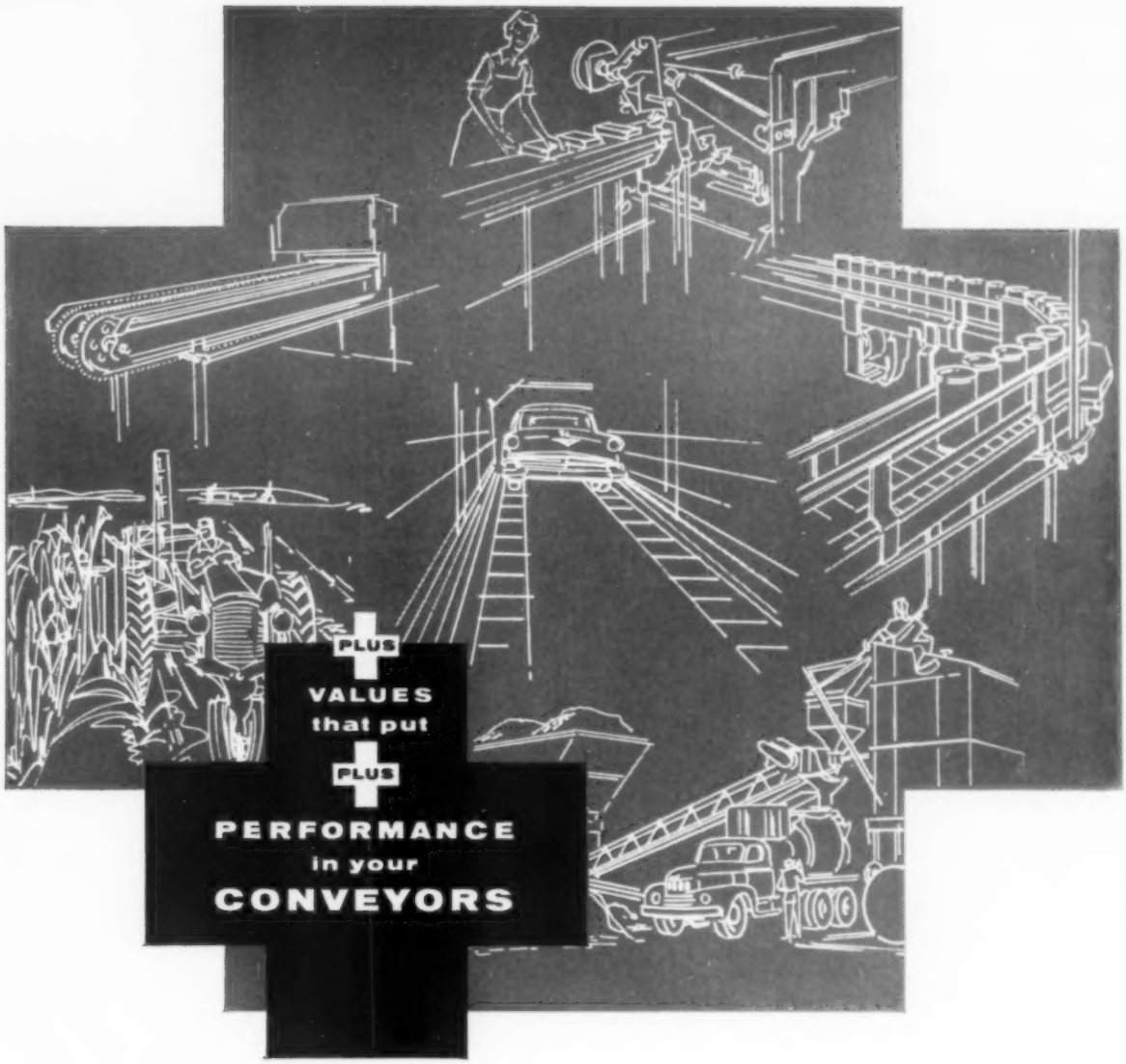
Unexpected . . .
. . . at this big East German display was a jet engine and this model of the 72-passenger airliner scheduled for test flights in May. Both are of local design. Plane has four engines hung in pods in the American fashion rather than in the wing according to British and Russian trend. The engine, designated Type 014, is rated at 6,946 thrust, is 161.42 in. long and 38.58 in. in diameter, has a 12-stage axial compressor. East German's aircraft industries may present America, Britain and France with a new source of competition.

Significance of this exhibit is the fact that hitherto no country aside from America and Russia has thought such a high-output, single-purpose machine an economic proposition. Use of such machines is only justified on long projection runs.

East Germany, on its home ground, presented by far the largest array of Communist products. Indicative of what priorities can do in a planned economy was its exhibit of a jet engine, something West Germany could not do, even though its overall industrial level is much higher.

It was the gaps in Communist industrial development—in machinery materials and product designs—that caused a record number of market-hungry western manufacturers to exhibit at Leipzig this year. Over 1460 West German firms set up shop in this iron curtain marketplace.

France filled an entire pavilion with the displays of some 120 firms, and Britain was the third-largest western exhibitor with nearly 100 companies represented.



What do we mean by *plus values*? They're the built-in extra strength...extra dependability...extra long life demanded in conveyor service. Conveyors just can't afford failures that can cause a complete plant shutdown...lost production time that can't be recovered.

To be sure of that protection against costly failures...to assure the dependable performance you want...specify CHAIN Belt conveyor and power drive chains, sprockets, roller bearings, flexible couplings, apron feeders and belt conveyor idlers. These are *plus value* products...designed and built to assure plus performance under any operating condition. And you get another *plus*...the application selection help of your field-trained CHAIN Belt District Sales Engineer. From his complete line of *plus value* products, he can help you select the exact component that will assure plus performance in your conveyors...from light-duty packaging to heavy-duty automotive assembly conveyors. The following pages tell why it pays to protect your good name with another...CHAIN Belt!

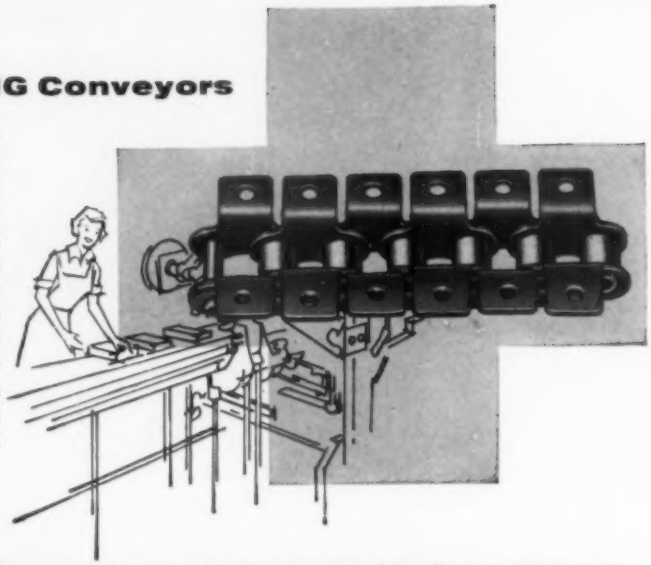
CHAIN BELT

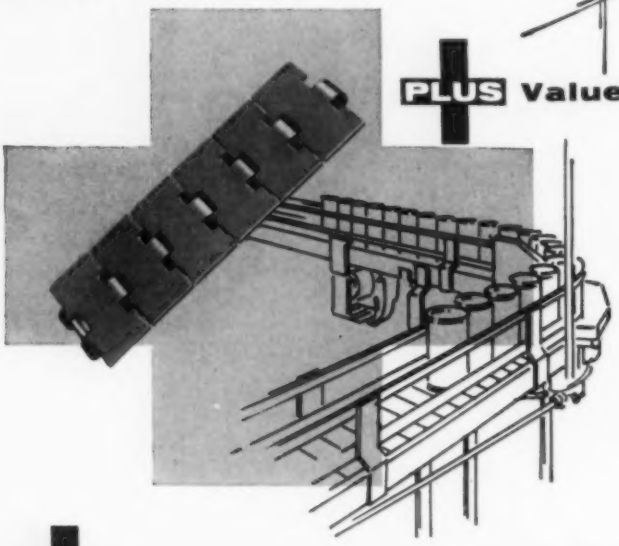
4715 W. Greenfield Ave., Milwaukee 1, Wis.

TURN PAGE

PLUS Values for PACKAGING Conveyors

In packaging conveyors, where high speed and accurate timing of operations are required, Rex Roller Chains provide *plus values* in longer service life...more efficient operation. Precise manufacturing techniques assure exceptional pitch control...an important advantage that assures exactly matched chain strands required in many conveyors. You get smoother operation...close control of packaging operations. Extra wear life and fatigue resistance are built into these quality chains with such important features as positioned seam bushings...designed-in beneficial stresses in link plate holes...round, matching rollers and bushings.



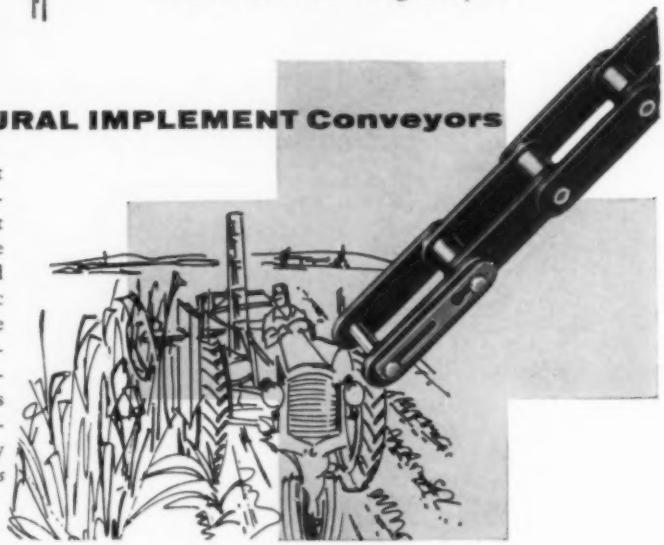


PLUS Values for CONTAINER Conveyors

For most efficient handling of bottles, cans, jars, cartons and small parts, your *plus value* choice is Rex TableTop Chains. Long the accepted standard in the food and beverage industry, these smooth-operating chains provide a level, virtually tip-free carrying surface. TableTop Chains are simplicity itself...just a platform link and pin. They stay cleaner...are easier to clean. No pockets to catch and hold foreign matter. No attachments to wobble or work loose. And TableTop is also available in Nylon. This is your choice where lubrication cannot be permitted...where lighter weight combined with smoothest handling is required.

PLUS Values for AGRICULTURAL IMPLEMENT Conveyors

To provide the efficient operation at economical cost required in agricultural implements, you need the *plus values* of Rex Implement Chains. These double pitch roller chains provide the smooth operation and strength of standard ASA roller chains but at lower cost. Five basic chains in this series offer the designer a wide range of selections to fit the individual implement requirement, and a complete range of steel detachable chains is also available. Whether the choice is based on greatest initial economy or longest overall life, there is a Rex Implement Chain to exactly fit your need. And all offer CHAIN Belt *plus values* in their service range.



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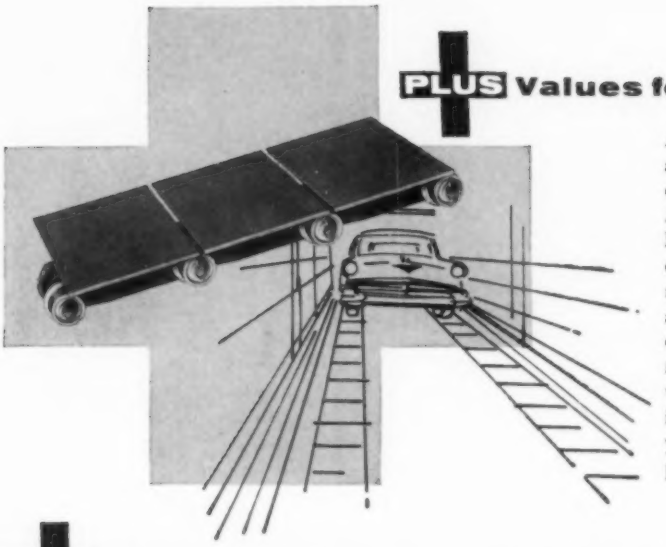
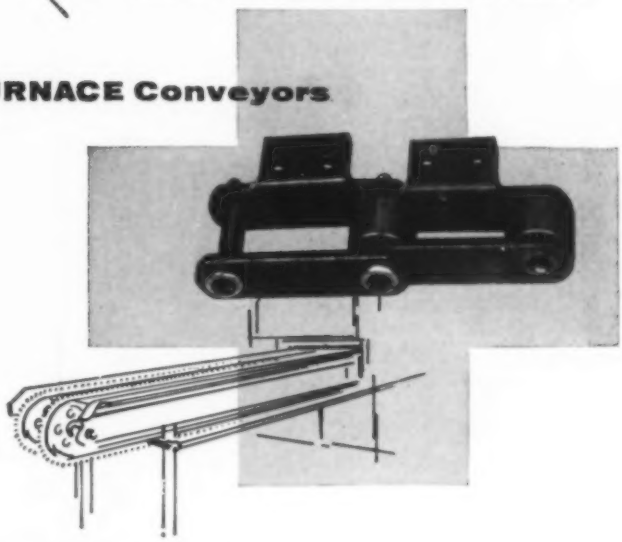


PLUS Values for ASSEMBLY Conveyors

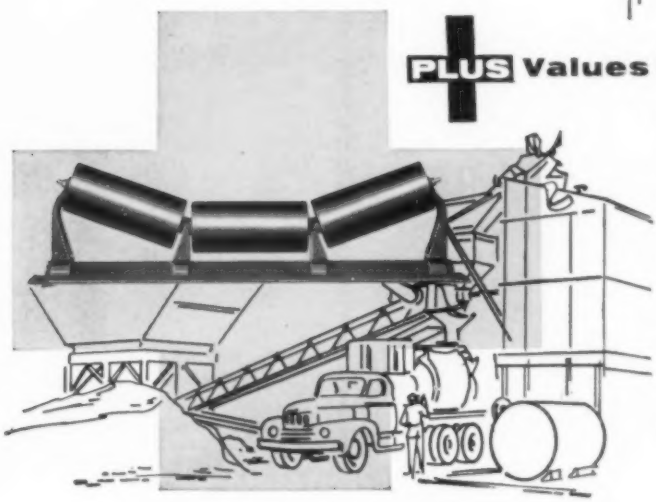
Automotive plants must operate on split-second assembly line production schedules. Failure of plant equipment cannot be tolerated even for seconds. Assembly line conveyors must be kept moving; Rex Automotive Line Conveyor Chains and Sprockets supply the *plus values* for smooth, dependable service. ***Plus values*** such as carefully held tolerances of all parts *plus* proper heat treatment, plus outboard rollers to reduce friction, all assure maximum smooth operating life and provide maximum wear life. Most assembly line conveyor chains originally used were Rex, many still in service after 25 years...today's *plus values* reflect many years experience of supplying the automotive industry.

PLUS Values for OVEN and FURNACE Conveyors

Many years experience is necessary to build the *plus values* required of chains for oven and furnace conveyor service. The wide range of loads imposed on these chains operating at higher than normal temperatures requires design engineering and manufacturing techniques acquired only through years of experience. *Plus values* of Rex Oven and Furnace Chains are all parts precision made to the proper tolerances for high-temperature service...correct materials...accurate heat-treatment techniques...experienced engineering and design for each individual application...rigid testing and inspection.



PLUS Values in BELT Conveyors



Rex Belt Conveyor Idlers are "rated" for service... assure you, in advance, of the life expectancy you want. Idlers are selected quickly and easily from simple selection charts. No need to buy more life than you need...no need to take less than you want. A complete line enables you to satisfy any requirement: troughing, return flat belt, self-aligning, impact cushioning, spiral return and special types...ball or roller bearing.

These are but a few of the many types of CHAIN Belt conveyor components that put *plus* performance into your heavy-duty conveyors. For complete information and selection assistance, write CHAIN Belt Company, 4715 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT

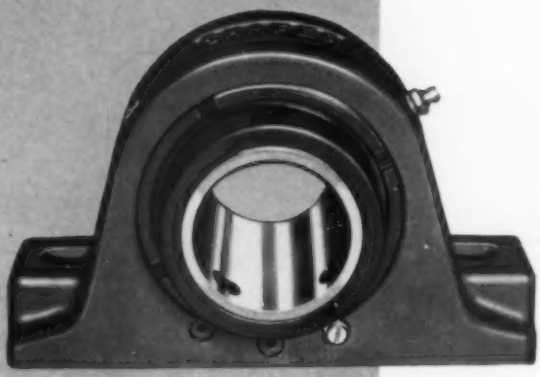
4715 W. Greenfield Ave., Milwaukee 1, Wis.

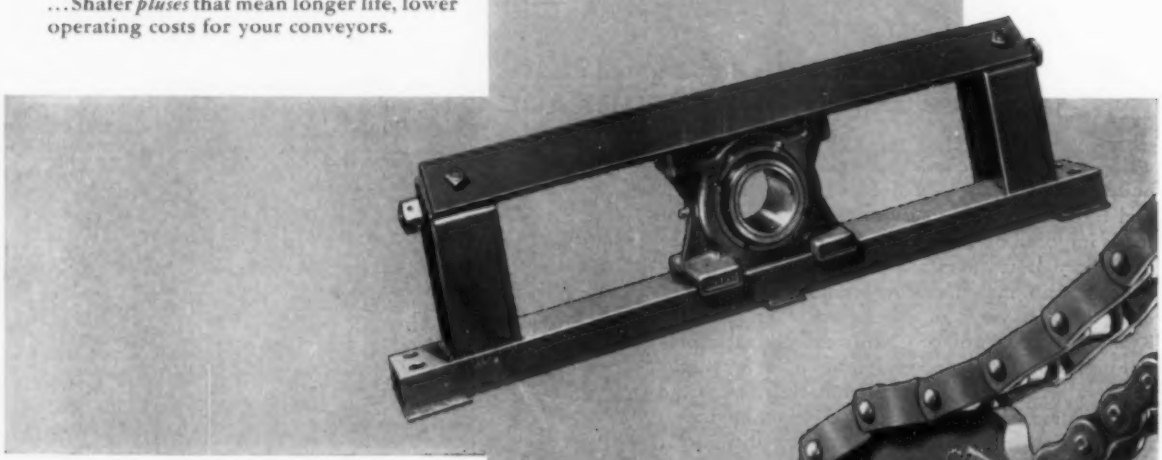
TURN PAGE

PLUS Values for any Conveyor

To put *plus* performance in any conveyor, take advantage of the *plus values* offered by Shafer Self-Aligning Roller Bearings...in pillow blocks, take-ups or cartridge units.

With Shafer you get *plus* capacity. They'll deliver their rated load capacity for five years and more. Compare this with other bearings that will carry the same load for less than a year. And the high degree of internal self-alignment provided by Shafer compensates for shaft deflection, shock loads and misalignment so common to heavy-duty conveyors. With these bearings you get the low rolling friction of a ball, the high load-carrying capacity of a roller ...Shafer *pluses* that mean longer life, lower operating costs for your conveyors.

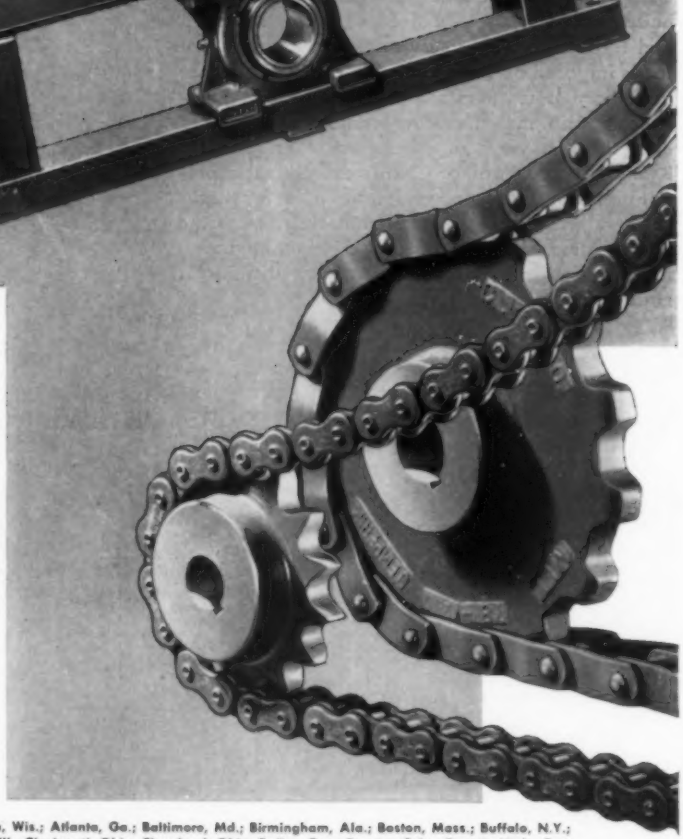




PLUS Values for any Drive

Rex Roller Chains add an important *plus* to your conveyor drives. They have the high fatigue strength and long wear life demanded in this service. Accurate pitch control, beneficial stresses in link plate holes, positioned seam bushings assure maximum fatigue resistance. Rex Chabelco Steel Chains are your *plus value* choice for heavy load, moderate speed drives.

For complete information on Shafer Bearings, write for Bulletin No. 55; for data on Rex Roller Chains, send for Bulletin No. 5725. CHAIN Belt Co., 4715 W. Greenfield Ave., Milwaukee 1, Wis.



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CHAIN BELT

Flywheels, Spark Plugs Make British Headlines

LONDON—British vehicle designers are introducing a variety of mechanical advances with their new models.

A simple independent suspension system will be included in the British Motor Co.'s new line of civilian jeeps. Rubber-in-torsion is the system's sole springing medium. Each wheel is mounted from a trailing link attached to a hollow shaft—the hollow shaft fits inside a cylinder. Space between shaft and cylinder is filled with rubber to cushion vibration. The system is simple and minimizes vibration.

To meet rigidity requirements, the jeep's chassis is made entirely of seam-welded box sections with rounded corners. The rounded corners reduce stress concentrations that occur at the corners of box sections when a torsion force is applied. Chassis configuration includes two parallel frame rails linked by seven transverse members, two of which act as bumpers. A two-speed transfer box is fitted behind the gear box. Differentials are standard.

Another British development is a flywheel said to reduce fuel and maintenance costs. The flywheel, known as a regenerative transmission system, is 2 ft in dia and rests between the engine and rear axle. Clutching is arranged so that energizing the flywheel brakes the vehicle and de-energizing accelerates it. One of Britain's leading bus operators is testing the design, which is expected to reduce fuel consumption 10% and lower brake-maintenance costs.

A new ignition system, in which the piston replaces the spark plug as the earth electrode, is said to eliminate carbon buildup in the spark gap of two-stroke. A stud fitted to the piston crown becomes the earth electrode. As the piston closes, a spark gap is created between the stud and the spark plug. The arrangement makes carbon-bridge impossible and helps keep electrode surfaces clean irrespective of temperature. The spark plug has no earth electrode.

Bits and Pieces

About 20% of the 30,000 members of the Engineers & Scientists of America, a national federation of collective-bargaining groups of engineering and scientific employes, have Professional Engineering licenses.

An automatic coal mine is the latest report out of Russia. Completely remote controlled operation will be incorporated into the Donets Coal Basin. No miners will work at the coal face, and all operations from moving the combines to hauling away the coal will be done automatically by a single operator watching the machinery over closed-circuit TV. When completed, the mine will produce 6-million tons per year. . . .

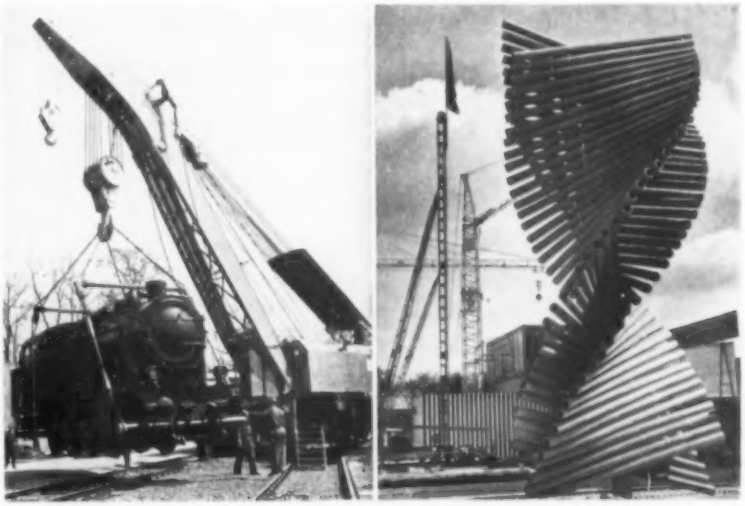
Willys Motors new gasoline-engine plant at Sao Paulo, Brazil, has an eventual capacity of 20,000 units yearly. Capacity of Krupp's forging plant, to be built in Brazil in association with Brazilian Mercedes-Benz, will be 48,000 tons a year. . . .

A maximum per diem of $100 for temporary consultants engaged by the Federal Government has been urged by the National Society of Professional Engineers, in recommendations made to Congress. Current per diem rate is $75. . . .

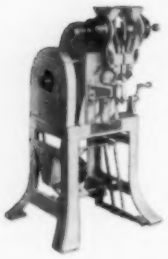
Of 7,500 employees of Aero-Jet-General Corps' Sacramento plants engaged in missile engine work, more than two-thirds are under the age of 40, a third are under 30. . . .

The Navy and Reynolds Metals, at the latter's Phoenix, Ariz., plant, have put into operation a 6,000-ton extrusion press designed for easy change from low to high speed without changing valves. This permits push-button switching from the working of nonferrous metals to steel. Change of containers can be done in 25 minutes. . . .

Although nothing has been made public about current projects, Marquardt Aircraft is looking for people with experience in "radiation shield design, neutonics, high-temperature and nuclear flux measurements, aerothermodynamics, development of control systems for advanced nuclear propulsion cycles". . . .



Converge on Hanover . . . as leading German Fair city gets ready to set up shop for the 1958 German Industries Fair, April 27-May 6. Items for display include late huge track-mounted mobile crane capable of lifting locomotives and unusual arrangement of piping resembling free-swinging escalator. Fair will feature wide-range of industrial products including: optics, iron and steel, tools and equipment, machinery, electrical circuits and wiring.



High strength and uniform quality are extremely important when tubular rivets are used in automatic assembly. Trouble-free operation is the only way to be sure of the cost savings resulting from mass production and automatic fastening.

Milford Tubular Rivets feed steadily from hoppers . . . they clinch easily and securely . . . they provide a rapid and economical fastening when properly used.

AUTOMATIC ASSEMBLY IS FAST, ECONOMICAL AND TROUBLE-FREE WITH MILFORD TUBULAR RIVETS

To cut delivery time and production costs . . . to improve product appearance and strength . . . to assemble your product on automatic rivet-setting machines—*get in touch with Milford first!*

THE MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • HATBORO, PENNSYLVANIA
ELYRIA, OHIO • AURORA, ILLINOIS • NORWALK, CALIF.

Machines Do Speedy Abstracts

NEW YORK—A system for using an electronic data processing machine to read technical articles and write abstracts of them was announced at the Institute of Radio Engineers Conference here. Called an "auto-abstract", the system will speed translation of foreign scientific articles as well. Human translators will have to translate only a short passage to get the gist of an article.

The machine produces abstracts by making a statistical analysis of the article. First, the full text is transcribed onto magnetic or punched tape in code that is comprehensible to an electronic data processing machine such as an IBM 704 computer.

Then the machine analyzes the text word by word to get statistical information about the frequency and distribution of words in the text. From this, the machine determines the significance of the words in the text and grades each sentence according to its importance. High score sentences are extracted and printed by the machine. The system was described by H. P. Lunn of the IBM Corporation.

New Home for ASM

CLEVELAND—American Society for Metals will start construction next month of a $2-million semicircular headquarters building in suburban Russell and Newbury Townships. The structure, slated for completion by mid-1959, will replace present downtown headquarters of the 30,000-member group.

The project is the first part of a five-phase program of metal-science education dedicated to the advancement of the metals industry. A $20-million expenditure for science buildings will eventually be involved.

The headquarters building will be dominated by a high all-metal geodesic dome, described as the world's largest "space lattice." This dome-to-be will measure 250 ft in dia. and 103 ft high, will contain about 5¼ mi of aluminum tubing and over 7 mi of ¾-in tension rods. It will stand on five support pylons

(Continued on page 30)

SPECIAL ON-THE-SPOT CONSULTATION

TALK TO THE MEN WHO KNOW THE ANSWERS . . .

Wagner Electric Corporation

brings

FACTORY ENGINEERING SPECIALISTS

to the

DESIGN ENGINEERING SHOW

to discuss your specific problems on

ELECTRIC MOTORS

1/6 through 1000 horsepower

CONTROL and ACTUATING SYSTEMS

Air and Hydraulic

You'll be welcomed at WAGNER BOOTH 558
International Amphitheatre—April 14 through 17

Wagner Electric Corporation
6400 PLYMOUTH AVENUE, SAINT LOUIS 14, MO., U. S. A.

Are you using wire cloth or wire cloth parts which must be corrosion resistant? Are the service conditions in your plant really tough? If you have a problem selecting the proper anti-corrosive alloy, Newark Wire Cloth may have the answer.

Available in all corrosion resistant metals, Newark Wire Cloth is accurately woven in a wide range of meshes, ranging from very coarse to extremely fine.

If you have a wire cloth problem involving corrosion, please tell us about it . . . we may have the answer.

NEWARK for ACCURACY

A complete line of woven wire cloth and wire cloth parts in all malleable metals.

Send for Catalog E

Newark Wire Cloth COMPANY

351 VERONA AVENUE • NEWARK 4, NEW JERSEY

bridged by 150-ft arches that will rise 30 ft above the ground. Footings will be anchored in concrete bases. The dome is reportedly designed to resist both hurricane-force winds and heavy ice loads.

The society's plans call for neighboring structures to house an engineering institute, a home-study and in-plant training program, a metallurgical-seminar institute, and a metals-science university.

New Gothic-Arch Uses

CLEVELAND—Gothic-Arch ball bearings are making a successful comeback, it was reported by New Departure at the recent Instrument Ball Bearing Conference in Cleveland.

The bearings, identifiable by their high contact arch-type races, show good results in thrust-load applications where space is limited and end play must be highly controlled—as in gyros and instrument-positioning shafts. In gyros, a single gothic-arch bearing ground to the magic contact angle of 34 degrees, 16 minutes to obtain isoclastic properties, can do the work of a preloaded pair.

Plastics are finding work in instrument bearings. A 0.001 in. thick coating of teflon acts as a gasket when sprayed on steel bearing shields to keep lubricant from being thrown out of high speed bearings.

Tests also show that teflon-sprayed separators prevent balls from skidding, thus avoiding bearing "lock up" and reducing torque. Teflon is sprayed on metal to get around its poor dimensional stability characteristics. For solid plastic ball separators, New Departure is happy with Delrin.

Dutch Ditch Dial Phone

AMSTERDAM—Dial telephones are passe in Holland. Phillips will equip its new Eindhoven plant with 800 key telephones. The company estimates that an employe can choose a four-figure telephone number in 2 sec with keys, saving 1.7 sec for each figure in the number. This adds up to over $4000 a year for 1000 telephones. The phones will be supplied by Phillips Telecommunication.

RMC Instruments for better Product Engineering

Tell us your requirements for indicating instruments or actuating switches and let RMC engineering skill go to work for you.

ROCHESTER
MANUFACTURING CO., INC.
214 ROCKWOOD ST.
ROCHESTER 10, N. Y.

RMC
LIQUID LEVEL, TEMPERATURE and PRESSURE INSTRUMENTS

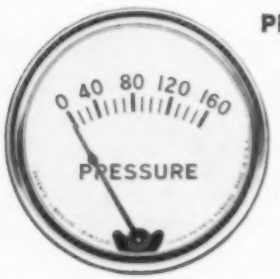
HIGH PRESSURE GAUGES

The RMC-Lindsay gauge, designed for pressures from 1,000 to 15,000 PSI, is a multiple coil, helical Bourdon tube type. The pointer is attached direct to the tube, without linkages or pivots. This gauge is made for extensive cycling, and will meet rigid vibration and over-pressure requirements—can withstand extreme conditions of shock, vibration or temperature. These gauges are made in various models to meet specified pressure requirements for a wide range of applications, including guided missile and jet aircraft service.

MODEL #6903-7 (Actual Size)

MODEL #6901
(Actual Size)

PRESSURE GAUGES



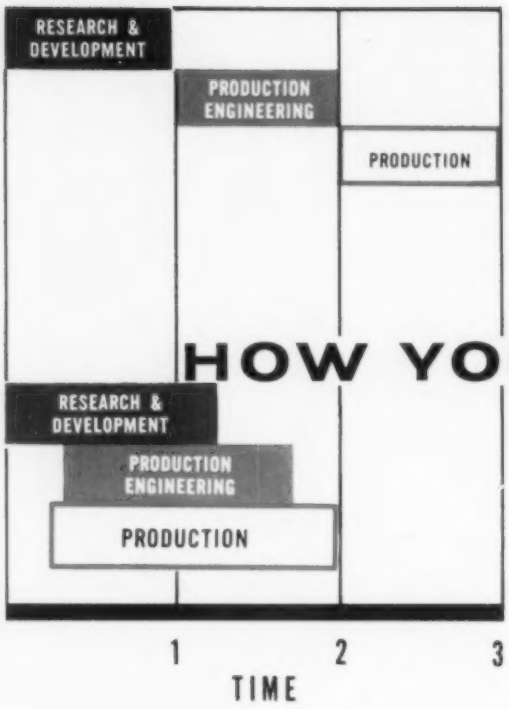
MODEL #2650—RMC pressure gauges are capable of withstanding very high overload pressures above a nominal scale reading. Various types are available in different models, sizes, etc. All are built for use on heavy-duty equipment, to maintain accurate readings regardless of mechanical vibration, or exposure to dust and weather.

PRESSURE/VACUUM SWITCHES

MODEL #2900—The RMC 2900 series is designed for service on vibrating equipment. Mechanism is sealed dust-proof and watertight. The diaphragm is Buna N impregnated and calibrated at the factory to close or open a contact at fixed pressure (or vacuum) values. Double or single terminal models. Pressures from 4 to 100 PSI. Vacuums from 4 to 26 in. Hg.

THERMOMETERS

MODEL #1848—RMC's general line of industrial thermometers cover just about every possible application. All are of stainless steel construction, with hermetically sealed dials. They are factory calibrated and pressure tested. External dial reset device permits on-the-job calibration for pin-point accuracy.



How to get a new product on the market in the Space Age—an age in which the tried and true method takes too long —as shown here by a leading Research, Development and Production organization . . .

HOW YOU CAN BUY TIME

ROY McCULLOUGH
Works Manager
AC Spark Plug Div.
General Motors Corp.
Milwaukee, Wis.

■ Your Product Planning Department comes up with a new idea. Market Research evaluates potential for the new product and suggests a price range. Research and Development goes to work and develops a prototype. Then Product Engineering works this over and comes up with drawings. Manufacturing engineering tools up for it and hands the job over to Production.

Nice, straightforward process. It works. It has worked for years. It's fairly economical and gets the product on the market . . . given time. Time may be one year, two years, three years.

But you haven't got time. A new product is needed NOW.

So you throw your comfortable, step-by-step, straightforward sequence to the winds. You roll up your sleeves, put your organization to work, and develop a new technique.

It has worked once, twice . . . many times.

HOW IT WORKS

Secret of the new technique is to overlap the steps. You don't skip any of them, but neither do you wait for one to be finished before starting on the next.

The start, of course, is Research and Development whose responsibility is to produce a functional, working prototype. It makes a survey to find out what others have done that can be used. The R & D people work out a rough solution and start on the first working model. From sketches they order parts, get them machined and put together into subassemblies, then go into final assembly.

As R & D begins assembly, engineers and technicians from Manufacturing are assisting, duplicating what's been done, learning to assemble and test. Meantime, others have gone over the sketches, getting ready to tool up for production of the parts.

As product tests proceed, original calculations are checked against performance, new tolerances are decided upon, perhaps more basic alterations of the original design are found necessary.

When a subassembly performing a specific function is satisfactory, Tooling gets the green light and places orders for new tools, or modifies the tools on hand. While Product Engineers are preparing final drawings and specifications, production methods are determined and routing sheets made.

All the while, Research and Development has been going ahead with its job, developing other subassemblies, testing them for performance of their function. As R & D goes along, Manufacturing keeps copying what's been done —learning by doing.

By the time the prototype is working successfully, Manufacturing knows how to produce and assemble the parts, how to check for individual and cumulative tolerances. And the tools are ready.

TEAMWORK

The flow of information is not only from Research and Development to the other members of the team. Tooling may point out the difficulty of producing a given part on time as originally designed. Product Engineering will come up with alternate—cheaper—methods of producing a given part, may suggest a better or a more easily produced subassembly that does the same job. New assembly methods may be devised to cut time and cost. The knowledge and

experience of the whole team is fed back and forth, brought to bear on the problem at hand.

While this process may slow down the pace of the R & D team, it eliminates many of the costly and time-wasting engineering changes that normally occur after a design has been finalized. The convergence of many persons upon one project, each person bringing a different professional point of view, serves to eliminate the mediocre, the expensive, the unnecessarily difficult solutions.

The resulting product often differs considerably from the original concept. In this it bears the mark of the teamwork that produced it. It is not a hand-made job. Parts are already beginning to come off production lines. Some subassemblies are already waiting for final assembly.

DRAWINGS AND ROUTING SHEETS

Up until this time Engineering has carried the major responsibility. After the prototype has been finished the production group assumes an increasingly greater share of the responsibility.

As the prototype reaches its final stages, drawing and routing sheets begin to come through. No special sequence is observed; even on the same product some parts may come first as drawings, others as routing sheets.

There is an intimate connection between the two, for the drawings show what is wanted, the routing sheets how to produce it. A routing sheet may have closer tolerances than the final drawing, it spells out the sequence of operations, tooling, gages for checking (process gaging). The drawing is the master plan, used especially for checking.

Because both production drawing and routing sheets are made after the prototype part or assembly has been built and tested, tolerances are those needed in practice, and allowances for soldering, brazing, welding—and for clearance—are not calculated, but determined from working model, without further need of checking during production.

GETTING THE PRODUCTION FORCE

By the time Research and Development is finished with the prototype product, Product Engineering is well along with its drawings and specifications, and a nucleus from Manufacturing already knows how to produce the parts, check them, assemble them, test them. Of this nucleus, a few understand the entire product and process, others the more limited section that will be their particular task.

The process of training personnel for quantity production is substantially a repetition of the process by which the first manufacturing men learned. They produce on the floor what they had learned to make in the experimental or development shops, and new workers copy their actions just as they had copied those of the development engineers. These workers in turn become teachers, so that gradually the necessary labor force is developed for full production.

As the teaching process goes on, new workers learn a progressively more limited amount, as each is required to perform a smaller part in the production picture. As a result, not only is specialization of labor achieved, but there are also a good number of people who have worked at and therefore know enough related jobs to coordinate the work of those with narrower specialization.

Production begins slowly, but often this is no handicap, as a similar process of learning must go on for those who have to use the new product. Tooling, also, develops at a gradually accelerating pace. Soon, not long after tooling is completed, the production force has snowballed and the new product is in full production.

THE TIME GAIN

How much time the new system saves depends largely on the type of facilities required to manufacture the new product. A time-saving of 30% to 50% is normal. If a new plant has to be built or new facilities ordered, the savings are not so great as when the new product can be produced in existing buildings with machine tools already on hand.

It must be remembered, however, that percentages are tricky. A one-third saving on a three-year program is one year. A 50% saving on a two-year program is also a year. In both cases, that one year may be the margin required for success.

OTHER GAINS

Though developed primarily to save time, the new system has other advantages. By bringing technicians and skilled craftsmen into the team at an early stage, engineering personnel are relieved of the noncreative tasks related to the production of a prototype. Each part of the team is more aware of the problems the others face, and better cooperation and understanding are encouraged. The method eliminates impossible "dream"—or nightmare—designs before they get very far along. It makes available to each member of the team the specialized skills of all the others, resulting in a practical, efficient design.

LIMITATIONS, TOO

In effect, this method carries the idea of designing by task group a step further, and the same precautions apply.

Too large a task group is unwieldy, trips over itself, gets nowhere.

All members of the task group must have a positive doer's approach. Criticism of a design or a production technique must be accompanied by a constructive suggestion for improving the design or substituting a faster, easier technique.

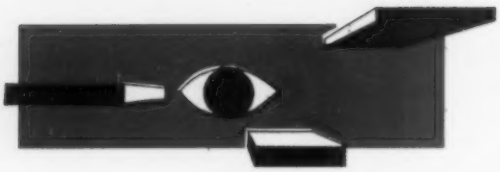
While cooperation is the very heart of the new system, responsibility must also be vested in some one person to cut down on discussion or unduly prolonged argument.

COSTS

Don't expect this cooperative system to effect miracles the first time. It is the result of a new philosophy, and all persons involved need to accept it and adjust to it. While adjustment is faster under the impulse of a pressing need, it takes time, just as it takes time to develop a winning team out of even a group of star players.

Most important, the various engineering and manufacturing specialists involved must be used to their capacity. By tradition each is supreme in his own domain. But cooperation is more important than authority here.

This method of working together can be learned and improves with each succeeding job. If it is carried on long enough, it will save not only in total elapsed time, but also in individual effectiveness of various team members. ■



POINTS

THE QUESTION: How Can Engineering Conventions Be Improved?

J. H. LANCOR

Vice-president, Engineering
Consolidated Electrodynamics Corp.

"I would like to see . . .

fewer technical conferences, with higher quality attendance and with technical papers written because the author has something to say rather than just because a committee chairman drafted him. There should be more debate-type meetings where the differing opinions of competing companies on a truly engineering problem could be presented to and discussed by their customers. This is the kind of meeting at which the people who influence engineering decisions will be found.

"Industrial shows offer a chance to expose engineers to ideas and products of other groups. This helps prevent 'inbreeding' of ideas by letting visitors compare and re-appraise their own efforts. However, shows have tended to become too big and too crowded to serve this function. This decreases receptiveness so that the attending engineer does not get the full benefit."

"Both the marketing of products and the exchange of technical information could be improved by decreasing the theatrical aspects of trade shows. Often, there is so much mutual inspection and discussion between exhibitors that engineers attending get less than the full amount of attention."

"Better coordination and more emphasis . . .

on quality of subject presented would certainly improve the effectiveness of engineering meetings and conferences. Our world of technology has expanded many-fold in recent years and parallel to this, so have our technical societies and related organizations. The rapid growth in recent years of the individual specialties within our basic engineering fields has created an extra-heavy demand on the two more commonly used techniques of dissemination—meetings and publications.

"Competition between technical organizations has become very keen and, therefore, the more these organizations can pool their efforts, the better the ultimate result will be for John Q. Engineer. He will at least have a sporting chance of hearing and digesting the material presented. As it quite often happens, the ABC Society will hold a meeting in New York at the same time as the XYZ Society meeting in Chicago. Although each society's primary field is unrelated, both have subject areas that overlap. Even worse, the very same situation has been known to happen involving only one society. The man interested in any of these areas has quite a dilemma, for he can not be in two places at the same time.

"As for the quality of subject presented, there is apparent room for improvement here. With the ever increasing meetings and conferences, it is not uncommon for a paper to be presented before one meeting and then up-dated or modified slightly so that it can be delivered at another meeting or meetings. These 'rehashes' and the 'sales pitch' that sneaks into engineering meetings every so often contribute little to our technical literature."

D. B. MacDOUGALL

Manager, Meetings and Divisions
The American Society of Mechanical Engineers

OF VIEW

RALPH H. ISBRANDT

Director, Automotive Engineering
American Motors Corp.

"A good conference . . .

requires careful advance planning in which the selection of topics, speakers, meeting places, times, and staging materials must all receive full consideration by those responsible for the conduct of the affair. It should be emphasized that *all* of the foregoing matters should receive attention, for many meetings are somewhat less than successful solely because a single detail was not handled properly before the meeting started. Unanticipated circumstances, such as a slide projector of the wrong size or a room that unexpectedly turns out to be too large or small for the size of the group, cause the audience to become restive, and greatly disturb the speakers who are often not polished performers and are apprehensive enough without having to cope with last-minute emergencies.

"Thus, the most susceptible area of improvement is concerned with the advance planning stage. This begins with clear understanding of the basic purpose of the meeting and carries over into thorough handling of the many details incidental to the accomplishment of that purpose. However, a technical conference can become over-organized to the point that speakers merely recite by rote and the audience leaves the hall with nothing gained. As television and radio producers know, a panel type of show involving a certain degree of audience participation provides extremely stimulating entertainment. This type of show could well be emulated to a greater degree by the organizers of technical conferences, for it provides a freedom of expression that stimulates thought on both sides of the rostrum.

"However, the success of such a meeting requires a strong moderator who is sufficiently versed in the subject under discussion and is adept at handling both panel members and the audience. This is a part of the all-important advance planning that can result in a good meeting in which speakers experience that warm feeling of genuine personal accomplishment, and the audience comes away with something of value."

"The first improvement . . .

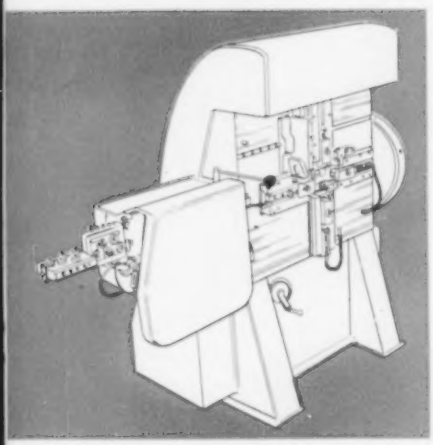
should be in the physical props that are needed for the presentation of almost every engineering paper. For example, when slides are projected, quite often the lettering is too small to be read at any distance. Frequently, families of curves are crowded on a single slide to such an extent that the true significance of the illustration is lost. All too often, projection equipment is not ready or fitted for the kind of slides or films which are to be shown. It is a puzzle why such things are discovered only after the audience is seated and comfortable. This same criticism also is applicable to the podium light, the microphone system and the other equipment necessary for a smooth meeting.

"Most engineering conference papers are well-prepared and edited. Too often, however, preprints are not available to the audience before the meeting. Thus, the possibilities of lively discussions are reduced. Most engineers are reluctant to indulge in controversial discussions without study. Many times, complex equations are presented without derivation or adequate references. However, almost all engineering speakers are guilty of this at one time or another. The presentation of test results and subsequent empirical derivations, is sometimes not backed up by the test description and conditions."

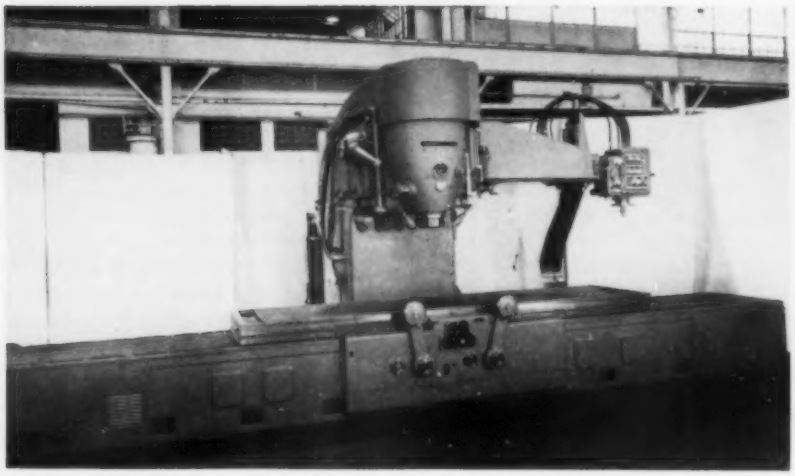
A. A. DALL,

Director,
Standard Machine Tool Engineering and Development
Cincinnati Milling Machine Co.

TRENDS in appearance



Bed of forming machine for wire and metal ribbon stands on end, permitting production of larger parts, which are gravity discharged together with scrap. Hood-shaped cover lifts off for access to gearing, cams, lube system. A. H. Nilson Machine Co., Shelton, Conn.



Vertical, hydraulically actuated milling machine has speed, fine adjustment and directional controls grouped where operator positions work for start of all cuts. Off-on and other power controls are on out-of-the-way arm. Handwheel brackets swivel to most convenient operating position. Lengthened bed accomodates rollup curtain, which keeps chips off ways. Machine can be modified for die sinking, profiling. Cincinnati Milling Machine Co.

Wrap-around disposable dust bag hugs blower to minimize space required for collection and stowage of dirt. Tricycle undercarriage allows cleaner to be towed by its cleaning hose. Designed by Sundberg-Ferar, Inc., Detroit, for RCA Whirlpool.

Claimed to be the lightest vacuum cleaner on the market, the 14½-lb package measures 3 x 13½ x 19 in. All attachments fit inside cleaner; unit may be stored on a shelf or under a bed.

design...

Wicker seats and open top make the "Jolly" an ideal means of transportation for hunting, fishing and golf. Wicker seats are cool in summer, easily cleaned and virtually waterproof. Open top simplifies loading of bulky hunting gear or golf bags. Produced by Carrozzeria Ghia, S. A., Turin, Italy, using a Fiat 500 body.

Welded aluminum body of this off-the-road dumptruck saves 11,000 lb of dead weight. Increase of approximately 16% in payload offsets the higher initial cost of aluminum. Smooth interior of body is heated by engine exhaust to simplify handling of wet bauxite ore. Body of Mack truck was produced by Heil for Aluminum Co. of America.

Dispensers for newest entry in highly competitive tape fields include cast-iron desk model. This material, coated with chip-resistant vinyl, lends weight plus ceramic-like finish, and fits nicely into modest production runs. Throw-away dispenser was designed for metal, but Behr-Manning Co. saves money by using plastic. By Laurence Brulin, for Jim Nash Associates, Inc., New York.

VOL. 1, NO. 2, FEBRUARY, 1958
ADVANCED
MATERIALS
TECHNOLOGY
The Science of
Materials for Profits
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A NEW Carborundum publication of news and ideas for all concerned with advanced materials for profits to industry

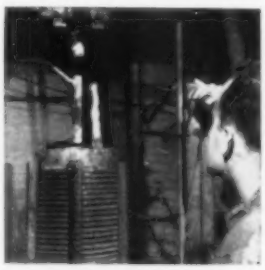
Almost every industry faces barriers raised by limitations of conventional materials. With some—aviation, for example—the hypersonic speeds of intercontinental missiles have meant finding materials capable of withstanding temperatures of more than 10,000° F. In other industries, like chemical processing, the urgent demand for corrosion resistant materials continues. In still other industries, the problems of abrasion, neutron transparency and the need for special properties have stimulated the search for advanced materials and manufacturing methods.

Carborundum is publishing *Advanced Materials Technology* as an aid to all those whose work demands materials and processes for severe service applications. It will be published quarterly. This publication—the first devoted exclusively to advanced materials and techniques—will prove invaluable in providing a new dimension in materials for profit.

This new service by Carborundum is offered to you without charge in the belief that it fills a definite need. *The Carborundum Company, Niagara Falls, N. Y.*

At left:

4700 F TEMPERATURE
measured by reflection



Measuring high temperatures with an optical pyrometer by means of light reflected in a mirror suspended over an induction furnace is the subject of the artist's illustration on the cover of the February issue. It was based on the photo above, taken in Carborundum's Research and Development Laboratories.

Typical features of each issue will include:

1. **New Developments** of interest to a wide cross-section of industry—including materials resistant to heat, corrosion, abrasion and other destructive conditions.
2. **Unusual Applications**—examples of the use of new materials to solve difficult problems and suggestions for similar applications in other fields.
3. **Problems in Materials Engineering**—a section devoted to questions and answers on materials and applications.
4. **New Product Spotlights**—new developments from the research laboratories and analyses of their properties and possible uses.

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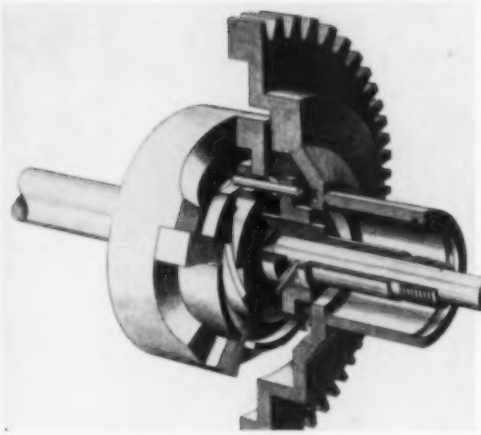
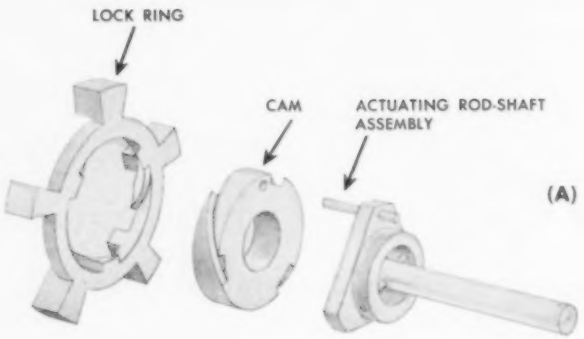
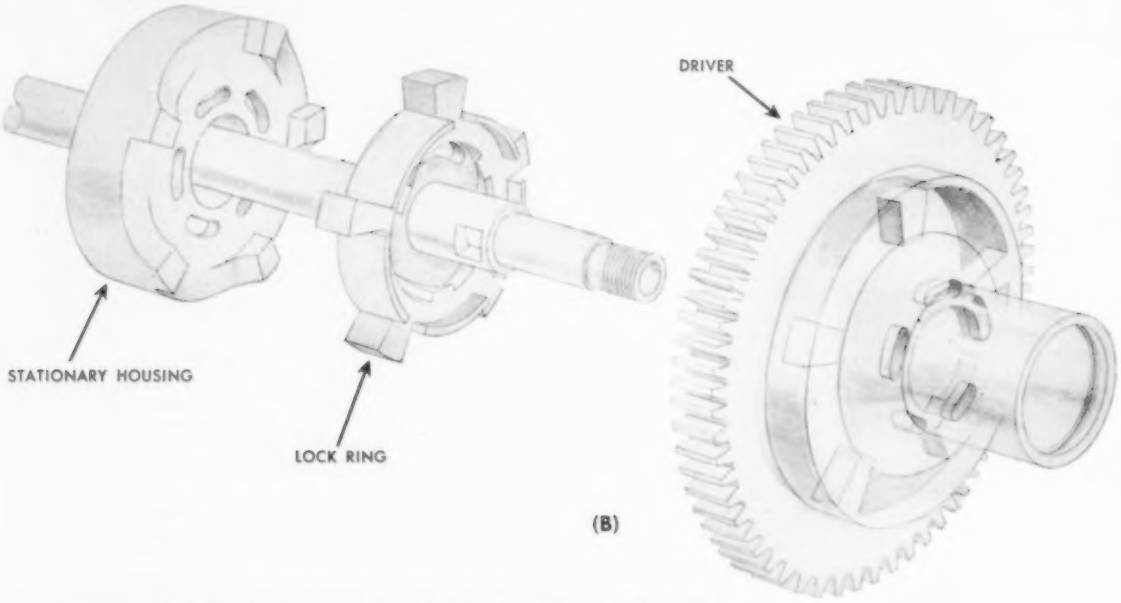






Timing clutch operates at high speed without slipping . . .

at speeds up to 1450 rpm. During normal operation, traveling lock ring (drawing A, above) is positioned so its locking lugs engage lugs on driver. Actuating rod and shaft assembly (drawing B) is held against driver by short end of actuating rod, engaging one of the slots machined into driver face.

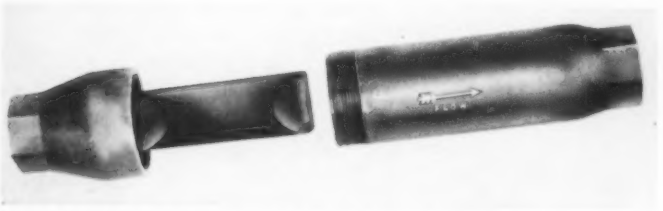
To disengage clutch, actuating rod and shaft assembly is moved by solenoid or other device so end of actuating rod leaves its slot in driver. Other end of rod simultaneously engages any one of the slots in stationary housing. As soon as actuating rod is seated, actuating cam is locked to housing. With actuating cam locked, and with torque applied to ring by driver, traveling lock ring is forced to slide axially along driven shaft. At this point, driver is disconnected from driven shaft. Driven shaft continues to rotate because of inertia, causing lock ring to continue its axial motion until its locking lugs engage stationary housing lugs. Prepositioning of the lock and moving components thus results in smooth transition without chatter.

To re-engage, actuating shaft is pulled back to its original position. The actuating rod enters any one of the slots in the driver. Rod locks actuating cam to driver and cam is forced to rotate with it. As cam rotates with driven shaft still locked to housing, traveling lock ring must slide along the shaft toward the driver. Its lugs disengage from housing lugs and re-engage driver lugs. Can be made so that unit always engages in same position.

Limited mainly by load requirements, this clutch can be made with any proportions or to any size desired. Price and delivery information are not available at this time. **General Electric Co., Lakeside Ave., Burlington, Vt.**

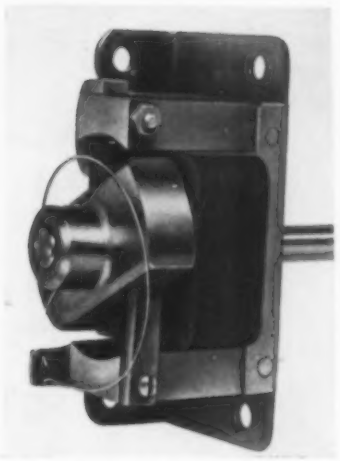
MATERIALS · EQUIPMENT

Thin-section bearings . . .
can be fabricated from almost every type of material, including magnetic and nonmagnetic stainless steel, SAE 52-100, aluminum, bronze, K-Monel, and ceramics. Bearing can be either of the full-complement or retainer type. Two typical bearings measure: bore, 110 mm, 140 mm OD, width 16 mm; bore, 30 mm, 42 mm OD, width 7 mm. **Ann Arbor Bearing and Mfg. Co., 815 Wildt St., Ann Arbor, Mich.**



Check Valve has inflatable rubber element . . .
permanently molded to a threaded nipple at intake end of valve. Flat, tube-shaped device deflates when flow ceases and opens to full area of pipe when flow is established. Resilience reduces line shock, and is said to trap foreign matter. Element can be added to many standard pipe fittings, and may be used as a foot valve, a vertical or horizontal check valve, or as an angle valve in any suction or discharge line. Available in ¾ in. size. With iron and steel body, $15; delivery, 1 wk. With bronze body, $25; 2 to 4 wk delivery. **Harman Equipment Co., 3605 E. Olympic Blvd., Los Angeles 23.**

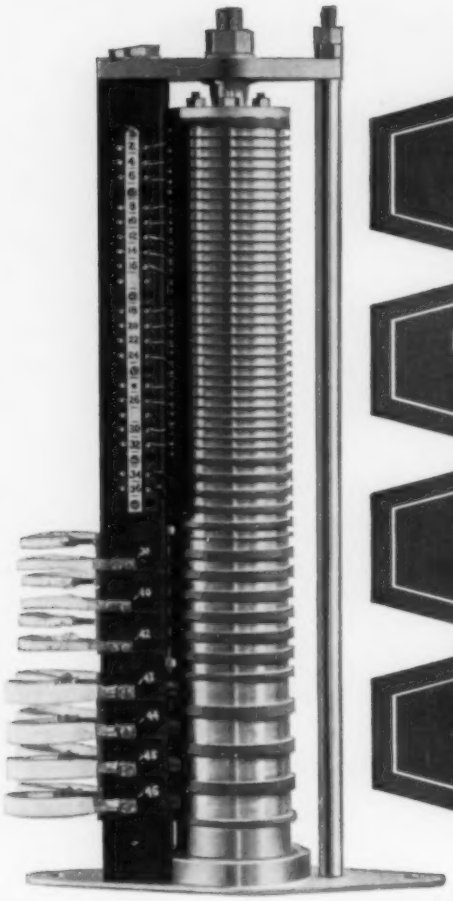
Liquid-filled potentiometer . . .
with all moving parts sealed in oil, is said to provide as many as 20 million shaft revolutions. Standard dry model with a special lid is sealed in an outer all-metal housing; leads are soldered to corresponding outer-housing terminals. Pot is then filled with oil under vacuum and three specially drilled holes allow oil to pass from inside the pot to space between outer and interior housings. Oil cushions unit. A 10-turn 1⅞-in-dia. potentiometer and 3-turn and 10-turn 2-in.-dia models, all for servo mounting, are now standard. Prices are 1½ to 2 times those of standard dry models. Prototype quantities are slated for 30-day delivery. **Helipot Corp., Newport Beach, Calif.**



Solenoid with adjustable control . . .
has two stops that allow selection of any portion of over-all torque curve and rotation. Either ac or dc input may be used; outputs of up to 4 in-lb are possible. Available in closed or open-frame type and in continuous or intermittent-duty models, with either left- or right-hand rotation. Operating temperature range is −65 F to 300 F. Standard operating voltage is 110 v, 60 cps, ac. Standard angle of rotation is 60°. In 1 to 1000 quantities, open-frame models range from $6.50 to $10.50; enclosed models, from $9 to $14. Delivery in 1 to 2 wk. **Lectronics, Inc., 30 Main St., Brooklyn 1, N. Y.**

Brazing flux paste . . .
chemically active from 900 to 3000 F, can be used for brazing stainless and other steels, Monel, Inconel, copper-nickel, bronze, malleable iron, nickel alloys, copper, tungsten, chromium carbides and other metals. Tensile strengths to 80,000 psi have been obtained when nickel-silver brazing in the lab. Available from stock at about $1.55 per lb. **American Products Corp., 422 S. Dearborn St., Chicago 5.**

Miniature ceramic parts . . .
are heat-resistant and suitable for use in temperatures to 1876 F. Parts are available in thicknesses down to 0.010 in., dia down to 0.060 in. and in lots of one to several thousand. Delivery in 1 to 2 wk after approval of specs. **Duramic Products, Inc., 262-72 Mott St., New York 12.**



COMPLETE SLIP RING ASSEMBLIES

BRUSH HOLDER ASSEMBLIES

BRUSH ASSEMBLIES

BRUSH CONTACTS

ONE OR ALL—

Created and Completed by Superior in their entirety

All phases of slip ring design and manufacture are covered by the Superior staff within the Superior plant. Slip rings can be (1) engineered and built to fit your application, or (2) made to your own design. There is practically no limitation as to size.

A long and far-reaching experience in the manufacture of brush contacts has speeded Superior's entry and broad-based service in the field of slip ring assemblies.

Write for Bulletin S-2056, sketching Superior's background in this broadening, highly technical field.

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BRUSHES • CONTACTS • SLIP RING ASSEMBLIES
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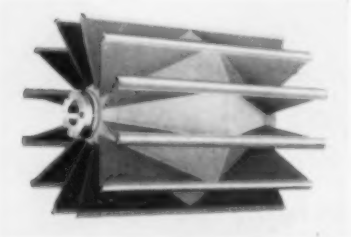
SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .

Soft or rigid magnetic surfaces...

result from compounding of neoprene rubber or other plastic materials with magnetic particles. Either shapes or sheet can be provided and magnetic strength can be varied or concentrated in a variety of patterns. Low-density magnetic flux over a large area is characteristic of this material. Already applied to various types of materials-handling equipment. **Herr Equipment Corp., 1426 Vine St., Warren, Ohio.**



Wing-type pulleys . . .

have demountable, tapered hub assembly said to minimize belting wear and thereby reduce replacement costs. Wing design detours spilled materials that might otherwise get between pulley and belting and cause abrasive wear and chemical reactions. Design also reduces contact area between the belting and pulley. Designed for heavy-duty service. **R. & J. Dick Co., Inc., Box 388, Passaic, N. J.**

Waterproof toggle switch . . .

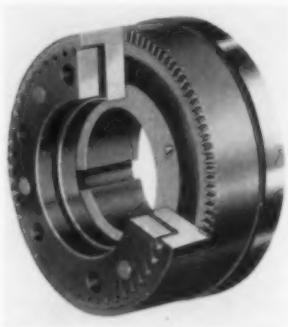
has stay-on, stay-off feature similar to a toggle switch but without the conventional toggle-switch mechanism. Protected against water and dust by a silicone boot enclosure permanently bonded to silicone leads. It can be furnished in various lead lengths. Electrical rating is 15 amp resistive at 115 v ac with an expected life of 25,000 cycles. **Control Products, Inc., 306 Sussex St., Harrison, N. J.**

Miniature cam switch . . .

can be used as a decimal-to-binary converter, a control or decade switch. Available in six and ten-position models, it is rated at 1 amp, 110 v ac and has a breakdown rating of 1500 v. Offered in single and double-ended designs for clockwise and counter-clockwise operations. Cam switch is for counting and control applications. **Tech Laboratories, Inc., 46 E. Edsall Blvd., Palisades Park, N. J.**

Adjustable Pneumatic relay . . .

can be attached directly to controlled motor or valve with an ordinary screwdriver and wrench. Relay counteracts the effects of friction and load factors that prevent proper response. It also compensates for extraneous factors and produces specified performance in new equipment. Adjusting screw can be set to delay operation until control pressure reaches a desired point between 2 and 15 psi. Distance of motor or valve-stem travel for various changes of control pressure can also be adjusted between 2 and 13 psi. One relay can handle multiple installations of four 6-in. or 10 4-in. motors. Recommended air pressure is 20 psi; max air pressure, 25 psi. Reliable performance is reported from 20 to 180 F. List price, $40. **Powers Regulator Co. of Canada, Ltd., 15 Torbarrie Rd., Downsview, Ont.**



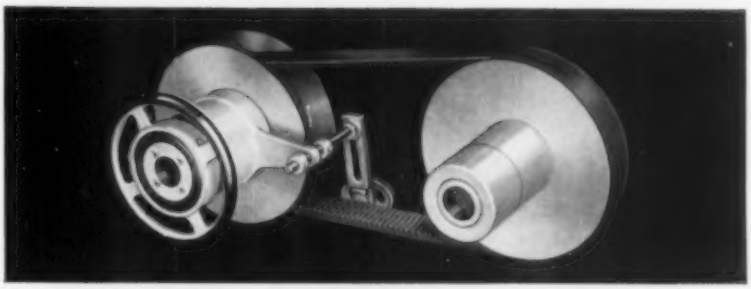
Electromagnetic tooth clutch . . .

for machine-tool use is available with torque ratings from 40 to 4000 ft-lb. The locking principle used to transmit torque features no idle torque, engagement to 300 rpm relative speed, and disengagement under full load while running at max rpm. A mounting adapter permits bolt-on design. In operation, clutch is said to have high torque transmission with reference to over-all dimensions. **McCauley Industrial Corp., 1840 Howell Ave., Dayton 17, Ohio.**

Laminating adhesive . . .

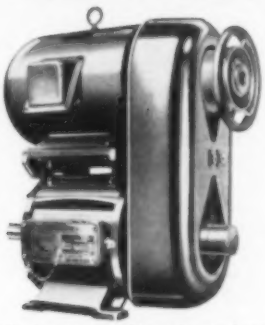
provides high-strength bonds between a variety of materials without heat or pressure. Bonds made between laminates and steel, aluminum or wood have shear strengths of about 500 psi. Bonds of wood-to-wood developed shear strengths to 300 psi after aging 5 days at room temperature. Retains strength at temperatures over 200 F. Can be applied by brush, spray or hand roller. The elastomeric base material can be used in industrial operations, for non-load-bearing sandwich panel construction and for bonding plastic-coated fabrics to rigid subsurfaces. **Minnesota Mining & Mfg. Co., 423 Piquette Ave., Detroit 2.**

DIRECTLY APPLY VARIABLE SPEEDS



LEWELLEN

COMBINATION PULLEYS



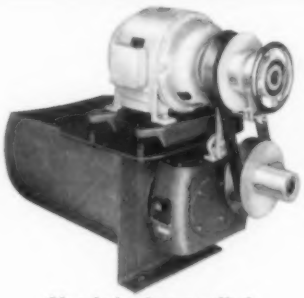
Motion-controlling Cycledyne with variable speeds

Connect any two shafts—incorporate infinitely adjustable speed ratios.

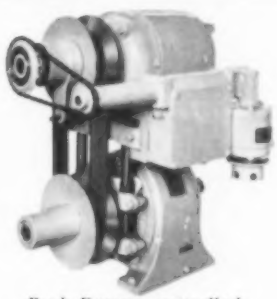
Control speed settings while running—accurately, conveniently.

Equip for flexible operation—compactly, economically.

SPEED RANGES TO 10:1
RATINGS TO 15 H.P.



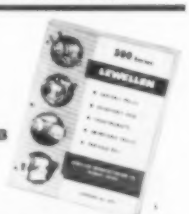
Handwheel controlled Medor Screw Conveyor



Push Button controlled Foote Vari-Mount Reducer

Chain Shifter controlled Falk shaft-mounted Reducer

WRITE FOR **CATALOG 60-B**



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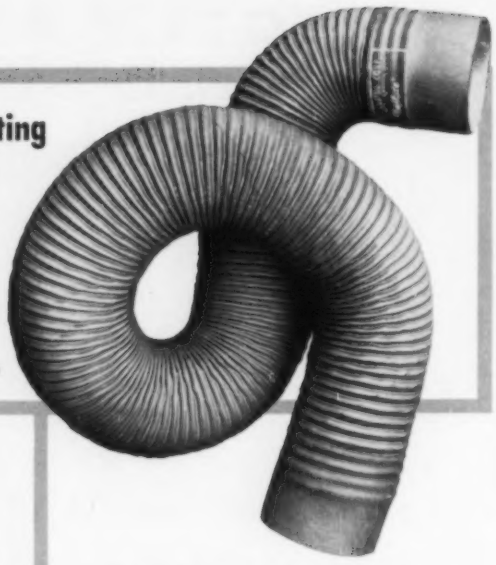
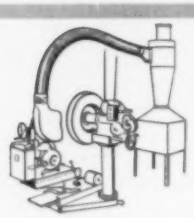
Distributors In All Industrial Areas In Canada—Peerless Engineering Sales, Ltd., Toronto-Montreal

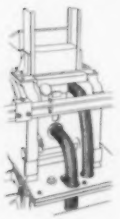
FLEXFLYTE ducting has unlimited applications

Here are 3 typical examples . . .

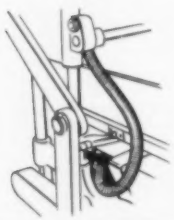




DUST COLLECTION Here Flexflyte is used as the connector duct from the abrasive wheel to the dust collector on a tire buffing and truing machine. It was selected because it has excellent resistance to abrasive rubber dust particles and the flexibility required by the movable head.



AIR HANDLING The ease with which Flexflyte can be fitted into cramped quarters makes it a natural for such tasks as providing suction for Univac's card feed.



MATERIALS HANDLING Flexflyte was specified for the circulating system of this gluing machine because it has the required strength and takes up little space.

Flexflyte® is one of a complete line of lightweight flexible ductings. It is basically a galvanized spring steel wire helix with spirally wound and permanently bonded, coated fabric coverings. Depending on type, Flexflyte can handle internal working pressures up to 70 psig and external working pressures up to 15 psig. It can take turns up to 180° without buckling; its temperature range is from minus 120F to plus 650F; and it will not support combustion.

Flexflyte is available in 12-foot lengths, many different special shapes, a wide variety of diameters and a number of standard coverings, linings and coatings. It can be specially engineered for unusual applications.

Our field engineers are always at your service. Let us know your requirements and we'll be glad to have one of them stop by and discuss your ducting problems with you. For full information on Flexible's complete line of ductings, write Dept. 254.

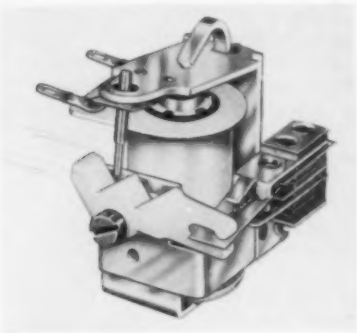
Flexible Tubing

Corporation

Guilford, Connecticut

Anaheim, California **Hillside, Illinois**

SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .



Impulse latching relay . . .

has an insulated rocker arm activated by a single coil. In this one-coil design, contacts are set up in one position when coil is energized or pulsed and return to first position on next pulse. Available for ac or dc operation, silver-cadmium-oxide gold-flashed contacts are offered in combinations to 4PDT. Rated 7½ amp at 115 v ac, resistive; ¼ hp, 115 or 220 v ac. Operates in ambient temperatures of —67 to 185 F. Terminals are solder lugs, pierced. For use in machine controls, appliances, positioning devices, and other applications where opposite switching is desired each time the circuit is pulsed. **Comar Electric Co., 3349 W. Addison St., Chicago 18.**

High-vacuum pump . . .

operates electronically and achieves clean vacuums in excess of 10^{-8}mm of mercury. Works in a closed system, utilizing electronic principles to ionize and remove gas molecules. With a pumping speed of 10 liters of gas per sec at 10^{-7}mm Hg, pump is small enough to be held in palm of hand. It has no moving parts. Current flow is reduced automatically as gas is removed and ionization declines. Pump measures its own vacuum. A microammeter furnishes a constant reading of pump current, which is a measure of the degree of vacuum achieved. Installation consists of one or more pumps with permanent magnets and a power supply. **Varian Associates, Tube Div., Palo Alto, Calif.**

Fluorocarbon film . . .

fabricates into bladders, tank liners and pressure equalizers that have resistance to high temperatures of jet-engine environments and sub-zero temperatures of high-altitude flying. They are reported to be unaffected by corrosive chemicals and all

solvents, except molten alkalis and fluorine gas at elevated temperatures and pressures. Bladders have been storage-tested for 3 mo without adverse effect. Bladders are available in any size and shape and are without seams. Recommended temperature range is from —100 to 400 F. On intermittent thrusts, bladders withstand 600 F. Liquids are expelled by gas injection, which empties 98% of the contents with high efficiency rating. **Joclin Mfg., Wallingford, Conn.**

Slow-motion photography . . .

of vibration tests, with the film running at normal speeds, is based on a technique of continuous visual slow-motion observation. In application, vibration test is illuminated by strobe lights operated by a synchronized observing instrument, which triggers a camera-synchronizer that in turn operates a pulse-type motion-picture camera. Only one exposure is made per frame, resulting in a slow-motion movie of the test when the film is run through a standard projector at normal speeds. Operator exerts pushbutton control over the test. Input of the system is a plus pulse from the synchronized observing instrument; output is a 30 v dc pulse at 2.6 amp. Requires 117 v ac power, 60 cps. Dimensions are 4 x 8 x 13 in. deep. Weighs 10 lb. Instrument is $435, not including camera. Delivery in about 60 days. **Chadwick-Helmuth Co., 472 E. Duarte Rd., Monrovia, Calif.**

Shock-resistant switch . . .

is designed with fixed mounting of the single-piece beryllium-copper blade midway between the actuating and contact ends. Side-mounted, snap-action Class 4 switch is UL-listed at 15 or 10 amp, 125 or 250 v ac noninductive; ½ or ¼ hp, 125 or 250 v ac. Available in four operating-force ranges. Over-all dimensions are $\frac{7}{16}$ x $\frac{17}{32}$ x $1\frac{3}{16}$ in. With spade, junior tab, solder lug or No. 4 screw terminals. Snap-on actuators can be applied. Class 1 switch, also available, utilizes same mechanism. **Detroit Control Corp., 5900 Trumbull, Detroit 8.**

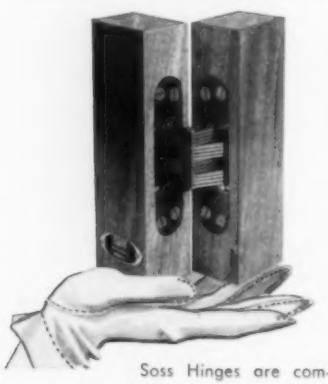
Need SPECIAL
ROTARY SWITCHES?
see
ESCO of WEYMOUTH
TYPE JR
TYPE P
gear-operated TYPE JR
TYPE A/AF
geared pair TYPE HT
TYPE JS-JD
TYPE HT
ESCO standard components are assembled to meet your requirements.
A deviation from one of our standard switch assemblies will give you a special switch at a standard-switch cost.
Over 90% of our production is special in one way or another.
These standard switches can be modified to fit your application:
• Type A — up to 8 positions, 7 sections maximum, detent mechanism, rating 5 amp. 125 volts a-c/30 volts d-c.
• Type AF — up to 8 positions, 6 sections maximum, detent action, rating with resistive load 5 amp. at 28 volts d-c or 115 volts 400 cps, per MIL-S-6807.
• Type P — Multi-section, up to 4 positions, snap-action, rating 10 amp. 125 volts a-c, 5 amp. 125 volts d-c, 30, 60, 100, 200 amp. 500 volts a-c, or 250 volts d-c. Can be assembled to meet Specification MIL-S-15291.
• Type JR — up to 8 positions, 30 sections maximum, detent action, rating 10 amp. 125 volts a-c, 5 amp. 125 volts d-c.
• Type JD-JS — up to 8 positions, 5 sections maximum, detent action or snap action, rating 30 amp. 230 volts a-c.
• Type HT — up to 16 positions, 10 sections maximum, detent action, rating 5 amp. 125 volts a-c.
• Geared-Pair Type HT — up to 16 positions, 20 sections maximum, detent action, rating 5 amp. 125 volts a-c. A single knob controls two Type HT switches assembled with a gear mechanism.
• Navy Switches — to MIL-S-15291 and Bureau of Ships drawings 9000-S6202-73075, 73826, 73827, 73295, 74422, and others.
Write for data sheets on individual switches or complete new catalog on ESCO rotary multipole switches. Send us your requirements and we'll give you full specifications on the ESCO switch that meets your need.
ESCO of WEYMOUTH
ELECTRO SWITCH CORPORATION
Weymouth 88, Massachusetts

Chances are it will be equipped with SOSS INVISIBLE HINGES

"The Hinge That Hides Itself"

Soss Invisible Hinges enable you to do a better job whether you're designing a rocket to the moon or a new typewriter.

NO PROTRUDING HINGE BUTT



Soss Hinges are completely hidden from view when doors or lids are closed. They are the only hinge that creates the flush, smooth streamlined surfaces so necessary for modern design. Unique Soss Hinges are available in a wide size range to meet every requirement.

For complete details, prices and free illustrated catalogue, write today to:

Soss MANUFACTURING COMPANY

Department 210, P.O. Box 38

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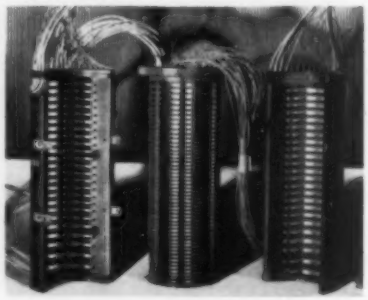
SIGNIFICANT PARTS MATERIALS EQUIPMENT . . .



48-ring power and signal . . .

assembly is fabricated with gold-plated silver rings and silver-graphite brush contacts. Can be used with gyros, thermocouples, servo motors, distributing circuits. Ring dia including brush block is 6⅜ in., height is 15 in. Current range, from smallest to largest rings, is 1 to 20 amp. Assembly withstood test of 2000 v, 60 cps, for 10 sec between rings. Ring leads are insulated with Teflon. **Superior Carbon Products, Inc., 9115 George Ave., Cleveland 5.**

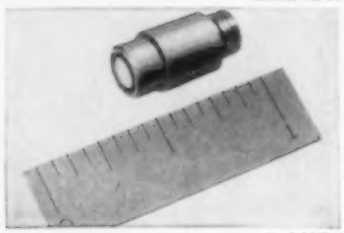
Low-cost silicon rectifiers . . .

are said to do the conversion job of vacuum tubes 590 times their size (3/100 cu in.) and 30 times their weight. Employ 0.00036 sq in. silicon wafers. Operate effectively to 212 F. Rated at 500 ma average rectified current at 212 F, eight types cover a range of 50 to 500 v. Prices, in quantity, are 40¢ to $1.50, depending on peak voltage. **General Instrument Corp., Automatic Mfg. Div., 65 Gouverneur St., Newark 4, N. J.**

Reinforced epoxy and silicone . . .

tubular structures provide dimensional tolerances of 0.001 in.; wall thicknesses as thin as 0.015 in. Epoxy components can attain a service-temperature range of —320 to 400 F; dielectric strength to 500 v per mil thickness; compressive strength of 22,000 psi and tensile strength of 22,200 psi. Flexural strength is said to be in excess of 32,000 psi. Current shapes are now 7 to 8 ft long on the round and 2 ft on square and rectangular structures. Tubing is centerless ground to dia ranging from ⅛ to 2 in. ID. Silicone structures provide service temperatures to about 392 F and are produced in square and rectangular cross-sections, in lengths of 18 in. to 2 ft. Additions of color pigments and fillers are possible. **Chemfab Corp., 40-30 23rd St., Long Island City 1, N. Y.**

Model PZ-14



Model PZ-6

Single Kistler Transducer Measures Pressures, Rates, Forces and Acceleration

Precise measurements of diverse pressures, pressure rates, differential pressures, forces, vibration and acceleration can now be made with one Kistler SLM Transducer.

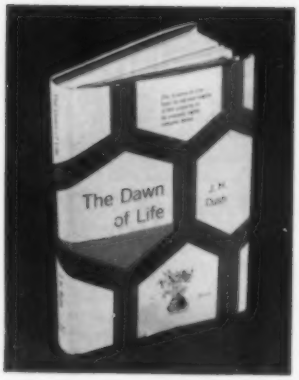
Providing advanced instrumentation for engines, compressors, shock tubes, gun tubes, rockets, hydraulic and pneumatic systems, the self-generating, crystal-type *SLM Pressure Pickup (Model PZ-14)* performs as follows: Measures pressure or pressure rate *directly;* displays all pressures from full vacuum to 3000 psi (100,000 psi with adaptors); covers frequency range of 0 to 50,000 cps; operates continuously at 600° F; withstands intermittent gas temperatures to 3000° F; indicates .1 psi variations at any pressure level to 3000 psi; measures fast pressure transients; makes short term measurements of static pressures. The *SLM Miniature Pickup (Model PZ-6)*, of the same basic design as the *PZ-14 Pickup*, achieves response times approaching one microsecond.

Transient differential pressures can be measured precisely at distant points by using two SLM Pressure Pickups opposite polarity. When pickup cables are joined, signals automatically add or subtract. An Accelerometer Adaptor with a mass, spring-loaded against the crystals, converts the standard SLM Pickup into a precision *Acceleration-Vibration Indicator.* Static calibration is accomplished by turning it upside down in the earth's gravity field, generating a 2G signal.

Utilizing a *Force Adaptor,* the SLM Pickup precisely measures forces to 300 lbs. with less than .005" deflection, and .1 lb. variations at any level. Larger forces may be accommodated by using several pickups with their signal leads joined.

SLM Pickups are coupled to oscilloscopes or recorders with electrostatic amplifiers *e.g.* Kistler Piezo-Calibrator-Amplifier units. A new Amplifier-Calibrator (Model PT-14), single or two-channel rack mounted, has fast response (0 to 200,000 cps), high gain (20), and low output impedance (7000 ohms). For complete information, request Bulletin S-114.

Kistler Instrument Corp., Dept. PE, 15 Webster St., North Tonawanda, N. Y.



NEW LITERATURE

The Dawn of Life

J. H. Rush, *Texas Technical College. Published by Hanover House, Garden City, N. Y.* 5½x8. 262 *pp.* $4.50.

"The function of intelligence is not to copy, but to invent." Thus does the author explain why man may eventually produce life in the laboratory, but why he probably will not produce an amoeba, a sunfish or a man. And that life may be based on silicon rather than carbon, or some other surprising chemical pattern.

Or again: "What is the unique power [over his environment] that man wields? . . . Power implies blind force, brute strength, energy rampant. Yet of these man has but little. In primitive competition, any of a thousand species can kill him. Yet he rules the world, and imposes his will on all other life. What, then, is the secret of his power? Paradoxically, it is freedom."

He goes on to explain that man is free to use his intelligence to put order in his efforts—and that this can be a danger if we let it lead to coercion.

These are some of the conclusions in this book, which is principally an explanation of the origin of life on our planet. Mr. Rush explains the chemistry of living things, how increasingly complex forms of life are developing, and where this process may lead. This is an absorbing compilation of the latest scientific information and thinking, by a skilled and absorbing author. EJT

Printed Circuit Layout Design and Application

A. C. Ansley, P. D. Horrocks, *published by Arthur Ansley Manufacturing Co., New Hope, Penna.* 8½x11; 16 *pp.* $1.

This brochure is based on answers to questions often asked by engineers about printed circuits and their application. The design of electronic circuits is discussed, particularly in relation to converting them into printed circuit boards. Production of the boards themselves, methods of etching and coating, tolerances, protective packaging are all described.

Perhaps the authors' own three-dimensional printed circuits will be of most interest in this brief discussion. These components are based on a type of modular design and are suggested for plug-in applications.

A Learning Machine

Abstracted from "A Learning Machine," by R. M. Friedberg, IBM Journal, 590 *Madison Ave., New York* 22.

Machines are needed that can perform tasks without precise, or even complete, instructions. Difficulties of providing such an ability are discussed. One proposal involves a stored program computer with the capacity to try or review various solutions and choose one. A test of such a design approach is described and results reported. This is the first of a two-part article.

One Hundred One Don'ts for Inventors

Frank Victor Higgins, *published by Varsity Press, 5716 N. 26th St., Arlington* 7, Va. 8½x11, 76 *pp.* $3.

This book is written and designed to help inventors avoid the errors they keep making. The author spent two years analyzing inventions, ideas, proposals and patents for the National Inventors Council, US Dept. of Commerce. Perhaps some of the suggestions will prove helpful; most seem quite obvious.

CENTRIFUGAL CASTING—Brochure, 8 pp. discusses advantages of bronze and copper parts fabricated in this manner. Describes technique, facilities and engineering services. A chart shows all alloys available with specific characteristics. Typical castings are illustrated. American Brake Shoe Co., 530 Fifth Ave., New York 36.

AIRCRAFT AND MISSILES—Booklet, 128 pp. "US Aviation Today," 1958, contains brief descriptions, photos, and engineering drawings of all US-manufactured aircraft and missiles in production, within the limits of military security. Includes general remarks, specs and performance data for each. This fifth edition, marking aeronautical achievements in 1957, is available from National Aviation Education Council, 1025 Connecticut Ave., N.W., Washington, D. C.

COLD-ROLL FORMING—Reference manual, 88 pp. Includes a discussion of the economics, mechanics and possible applications of this process to various manufacturing operations and offers data for selection of correct size and capacity of equipment. Production costs, operating speeds, tooling, surface finish, uniformity, forming of precoated stock, personnel training, and operating techniques are described in relation to end-uses and raw stocks. How-to instructions on curving, coiling, ring-forming, notching, perforating, welding and embossing are included. Yoder Co., 5500 Walworth Ave., Cleveland 2.

PLANNED PRODUCTS—Bulletin, 4 pp. Outlines six services for carrying an idea from formative stages through pilot production. Describes facilities, equipment and personnel and discusses research costs and the conditions under which client projects are undertaken. Designers for Industry, 4241 Fulton Pkwy., Cleveland 9.

COMMERCIAL STANDARDS—Catalog 978, 12 pp. Lists Standards available on quality requirements, test methods rating, certification and labeling of commodities and for providing uniform bases for fair competition. Commodity Standard Div., US Dept. of Commerce, Washington 25.

SIMPLIFIED-PRACTICE RECOMMENDATIONS—Catalog 979, 13 pp. Alphabetical list of recommendations for manufactured products to be retained in stock after excessive variety has been eliminated. Recommendations are available in printed form. Commodity Standards Div., US Dept. of Commerce, Washington 25, D. C.

OPTICS PLUS—Publication, 8 pp. Volume I, No. 1 of house organ reports on activities of the Engineering and Optical Div. Perkin-Elmer Corp., Norwalk, Conn.

Publisher's Postscript...

A man lived by the side of the road . . . . and sold hot dogs.

He was hard of hearing, so he had no radio.
He had trouble with his eyes, so he had no newspaper.
But he sold good hot dogs.
He put up a sign on the highway, telling how good they were.
He stood by the side of the road and cried, "Buy a hot dog, mister."
And people bought.
He increased his meat and bun orders and he bought a bigger stove to take care of his trade.
He got his son home from college to help him. But then something happened.
His son said, "Father, haven't you been listening to the radio?
There's a big depression on. The International situation is terrible, and the Domestic situation is even worse."
Whereupon the father thought: "Well, my son has been to college. He listens to the radio and reads the papers, so he ought to know."
So, the father cut down on the bun order, took down his advertising signs, and no longer bothered to stand on the highway to sell hot dogs.
His hot dog sales fell almost overnight.
"You were right, son," the father said to the boy. "We are certainly in the middle of a great depression."

■ This little story was published some years ago during a period of business adjustment much like what we are experiencing today. And the shoe fits, doesn't it?

The more people who wail when business turns downward, the more others tighten their purse strings . . . and reduced spending largely accounts for our problems today.

We have always recovered from our business slumps—and later made impressive gains. This one will be no exception. But we need to rebuild national confidence in our continued growth.

The engineer, because his opinion carries weight, can contribute to an early recovery by maintaining a constructive and optimistic attitude about the future. Our economy is nowhere near as fickle as some businessmen seem to think. For a change, let's salt their apparent hysteria with a little logic—if engineers keep from panicking, businessmen may do the same.—AH

SEARCHLIGHT SECTION

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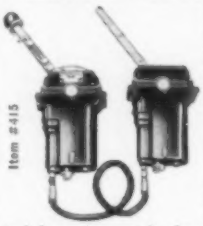

For remote operation of controls on engines, boats, special machinery, etc. Eliminates complicated mechanical linkages, cables, pulleys, etc. Master unit connects to slave unit with a single ¼" tube. When master control lever is moved, slave lever follows exactly. Light-weight, compact aluminum alloy construction. Dimensions: 5¼" W. 9" H. 1¾" D, (exclusive of handle). Shipping Weight: 8 lbs. (Note: Tubing is not supplied)

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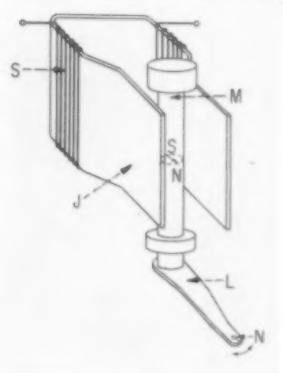
74 for Your Information (personal)

Nylon goes to the dogs

Molded nylon and a special odorant are combined in a dog's delight: a tough, safe, delectable bone. The odorant is undetectable by humans, but it's said to smell like a fresh and fragrant ham bone to a dog. It's incorporated in the molding compound (Du-Pont's Zytel 101) so it won't wash out. The bone is made in three sizes (for small, medium and large-sized dogs) by Nylabone Corp., Oklahoma City 12, Okla., priced at 89¢, $1.39, and $1.99.

Special-purpose odorants like the one used here are, incidentally, increasingly important in industry. In addition to the odor-masking compounds widely used on products ranging from adhesives to refrigerants, there are warning compounds for potentially dangerous but odorless gases, and a variety of spice and food odorants for use in inks, coatings, and the like.

New pickup for Hi-Fi



A phono cartridge with a new-type armature in which the magnet moves and the coil is stationary is claimed to provide an unusually wide frequency response (10 to 20,000 cps) and a high output (35 millivolts) with high compliance and low mass at a relatively modest price—$29.

Using what the manufacturer, Norelco, calls a "magneto-dynamic" principle instead of the usual electrodynamic arrangement, the pickup features a ferrite magnet (M), magnetized perpendicularly to its axis and rotated by the transverse vibrations of the cantilever stylus bar (L). A varying flux induced in the core (J) develops a corresponding voltage in the coil (S). A 1-mil diamond stylus (N) provides the driving force. Boasts Norelco: this new design "combines the ruggedness and high output of the variable reluctance type cartridge and the linearity of electrodynamic types, with none of their disadvantages."

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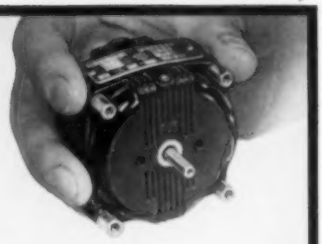

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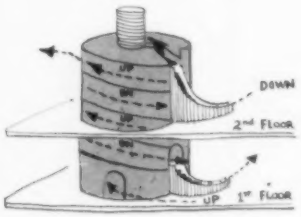
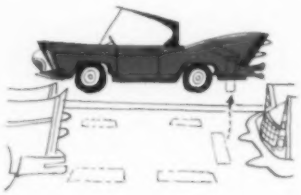


... a spiral escalator for modern buildings? Proper placement of entrance and exit levels would permit them to be located near each other rather than with widely separated entrances. Ingenious design should permit use of the same tread for going up and down many floors. The spiral might be left open, or glassed for ultramodern appearance. —B. MARIE



... a mounting for automobile spare tires, that would serve a useful purpose? If it were fixed to a shaft free to swing in a vertical arc it could lower, lift the rear wheels just off the ground and permit the car to swing about the front wheels. Parking would be a cinch—you drive diagonally into a small parking spot, lift the rear wheels, and simply push the rear end directly to the curb.

—E. A. KREMEYER

... door and window hardware made of rubber or plastic that is really silent. It would be particularly helpful in infants' or children's bedrooms, and in hospitals. Also how about nylon-lined hinges to stop the squeaks?

—V. J. PERILLO

... a hammer that would hold and dispense nails one at a time? The one-handed operation would vastly simplify nailing in awkward places, or where the workman needs to hold on for safety or just to keep his work in proper interrelation. —R. C. GASTON

... a floor tile (asphalt, linoleum, vinyl?) with adhesive on the back? Pull off a paper protector, heat tile, lay it, and you're done. Or how about an adhesive in sheet form to be laid on floor? Heat tile and simply press on the adhesive sheet. —E. J. HILLS

Have you a pet project but neither the time nor inclination to do the necessary R & D? Product Engineering will welcome (and pay $10 each for) similar ideas based on known scientific principles but lacking an inspired manufacturer

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